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From credit growth to credit crunch: Analysis of responses to credit development in CEE region

MASTER THESIS

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Abstract

This thesis analyzes policy measures taken to curb the private sector credit growth in the period 2003-08. The thesis evaluates the excessiveness of the credit development in the CEE with respect to macroeconomic fundamentals. Based on the results, menu of policy options to counter adverse effects of the credit boom is reviewed. The analysis is based on a survey performed on eleven central banks in the region. The findings reveal high intensity of policy intervention: altogether 82 measures were taken in CEE in the period. Deriving from the country experiences, the thesis argues that in order to eliminate adverse impacts, policy measures should include combination of monetary and prudential tools with special emphasis on domestic environment and role of foreign banks in the CEE region.

JEL Classification	E44, E51, E52, E58, G21
Keywords	Credit growth, monetary policy, prudential and supervisory measures, CEE

Abstrakt

Tato diplomová práce se zabývá analýzou opatření, která byla přijata v letech 2003 až 2008 s cílem omezit úvěrový růst v soukromém sektoru. Práce hodnotí nadměrný vývoj úvěrů v regionu střední a východní Evropy s ohledem na makroekonomické fundamenty. Na základě výsledků analýzy posuzujeme možná opatření proti nepříznivým efektům nadměrného úvěrového růstu. Analýza je založena na průzkumu jedenácti centrálních bank regionu a její výsledky prokazují vysokou intenzitu intervencí: v průběhu sledovaného období bylo v regionu přijato celkem 82 opatření. Na základě zkušeností vybraných zemí docházíme k závěru, že opatření by měla zahrnovat kombinaci monetárních i prudenční nástrojů se speciálním důrazem na domácí prostředí a roli zahraničních bank v regionu střední a východní Evropy.

Klasifikace JEL	E44, E51, E52, E58, G21
Klíčová slova	Úvěrový růst, monetární politika, prudenční a dohledová opatření, CEE

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Declaration of Authorship

The author hereby declares that she compiled this thesis independently, using only the listed resources and literature.

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Prague, May 20, 2011

Signature

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Master Thesis Proposal

Author	Bc. Martina Jašová
Supervisor	PhDr. Adam Geršl, Ph.D.
Proposed topic	From credit growth to credit crunch: Analysis of responses to credit development in CEE region

Topic characteristics The aim of the thesis is to discuss the credit development in emerging markets, in particular in the CEE region. In the pre-crisis years region witnessed a rapid credit growth that was subject to extensive debates. Scholars and policymakers questioned whether the rapid credit growth is a sign of a fundamentally based "catching-up" effect or an early warning indicator. As a result they attempted to analyze the risks and develop adequate instruments in order to limit the credit growth.

In the thesis, I would like to focus on the assessment of the instruments applied in the CEE region in the pre-crisis years. Furthermore, I will also try to deal with the development in the crisis period, i.e. whether and why these instruments have been abandoned.

The thesis is to consist of two main parts: theoretical and empirical. In the theoretical one I would like to analyze the credit growth instruments both from global and country-specific perspective. The empirical part will be based on the valuation of the efficiency of the instruments via event-study method.

Methodology The theoretical part of the thesis will be mainly based on a literature published before the credit crunch. Firstly, there has been substantial research regarding the determinants of the rapid credit growth in CEE region. Hence the key task of the first part is to answer the question whether the rapid credit growth can be considered to be fundamentally based or not.

Secondly, Enoch and Otker-Robe (2007) â€“ an IMF volume published as a result of conference of CEE jointly held by IMF and National Bank of

Romania discusses not only the risks but more also the instruments used in order to prevent from the rapid credit growth before 2005. Next, the credit crunch part will be primarily based on the country-specific IMF FSAP reports.

Furthermore, the responses of the national authorities will be collected in form of a questionnaire. Simple questionnaire will attempt to collect the most essential data about the specific instruments and their timing.

The empirical part will be based on the event-study analysis of credit data time series. Event study method is an econometric technique used to estimate and draw inferences about the impact of an event in a particular period. In this case the event is the introduction of a new instrument. Knowing the timing of implementation, it can be possible to show potential effect of the instrument. Credit data will be retrieved from IMF International Financial Statistics (IFS) and adequate questionnaire responses.

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   (c) Discussion of the results
5. Evaluation: Instruments and their efficiency

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Supervisor

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Acronyms

BE-3 Baltic economies
CEE Central and Eastern Europe
CEE-5 Central European economies
CNB Czech National Bank
DID Difference-in-Differences
DTI Debt service-to-income
EU European Union
FX Foreign exchange
GDP Gross domestic product
HH Households
HNB Hrvatska Narodna Banka / Croatian National Bank
IFS International Financial Statistics
IMF International Monetary Fund
LAR Liquid asset requirements
LTI Loan-to-Income
LTV Loan-to-Value
MRR Marginal reserve requirements
NBP National Bank of Poland
NPL Non-performing loans
PMGE Pooled mean group estimation
PPP Purchasing power parity
ROAE Return on Average Equity
RR Reserve requirements
SE-3 South-eastern European economies
SRR Special reserve requirements
VECM Vector Error Correction Model

Chapter 1

Introduction

The experience of Central and Eastern European countries over the years 2003-2008 is extraordinary in many ways. The credit developments is no doubt an evidence. Until the eve of global financial crisis, majority of the economies witnesses an unprecedented credit boom. With the impact of the crisis, the boom was suddenly discontinued and turned into a credit crunch.

This thesis tracks the period from credit growth to credit crunch (2003 - 2008) with a special focus on policy measures taken to alleviate the adverse effects of the credit growth. Credit growth is an inherently beneficial process. Its revivals are seen as sings of healthy banking system and confidence in the economy. Moreover, in case of CEE region the dynamics was also justified by catching-up with Western Europe. On the other hand, excessive credit growth increases imbalances and can contribute to amplifying vulnerabilities of the financial system.

In order to analyze the policy responses, we first need understand the nature of the phenomenon. In the first part the thesis we look closely at the issue: How much credit growth is too much? The answer will be provided by combination of concise literature findings and panel FE-OLS model that compares actual credit-to-GDP developments with derived long-run equilibrium levels.

The objective of this thesis is to analyze the policy responses to the credit developments. In particular, it aims to answer a set of questions: What instruments were used the most? How effective were they? What were the implementation challenges? How did agents circumvent the measures?

The main contribution of this thesis is that the evaluation is performed upon the results of a survey that was conducted on eleven central banks in CEE. Having the survey return ratio of 100% , the analysis builds on a unique dataset

of policy responses for given period. We record 82 policy interventions taken over six years in only eleven CEE countries. This is not only a rich experience for the region but also an ample pool of lessons for design of monetary, prudential, supervisory or administrative measures elsewhere.

The thesis is structured as follows: Chapter 2 focuses on the overall credit growth characteristics in CEE. Furthermore it performs an out-of-sample econometric analysis to evaluate whether the credit development of the countries was excessive. Chapter 3 discusses the strengths, weaknesses and potential implementation issues of policy instruments to curb the credit growth. Chapter 4 presents results of the survey conducted among central banks in CEE. Chapter 5 assesses selected country experiences by applying event studies that track the application of the tools. Chapter 6 concludes.

Chapter 2

Credit growth in CEE

2.1 Some stylized facts

Financial systems in CEE countries are predominantly bank-based and the key role is played by foreign banks. 85% of financial assets in CEE are bank assets. Over last almost two decades, banking sector has undergone transformation including changes in ownership, extension of banking services, reforms in regulation, prudential measures etc.

Table 2.1 illustrates the ownership developments of the banking sector in period 1999-2007. As can be inferred, consolidation of banks took place in all but Baltic countries. Even though the total amount of banks decreased, influence of foreign-owned banks strengthened over the time period. This can be observed by an increase of total number as well as asset share of the foreign-owned banks[1]. On the other hand, the privatization of banks resulted in a dramatic decrease of asset share of state-owned banks.

The developments in the researched (sub)period 2003-2007 are less clean cut. The overall structure of the banking sector did not evolve significantly. Foreign banks maintained stable importance through means of both number of institutions and their asset share. Consolidation of the sector was mostly over[2] and total number of banks began to rise, yet again this was largely subject to the entrance of new foreign-owned banks.

[1]Total amount of foreign-owned assets reached the level of more than 80% with exception of Latvia and Slovenia.

[2]The process of consolidation was still present in Balkan countries, mainly Croatia and Bulgaria.

Table 2.1: Banks and their ownership in CEE (1999-2007)

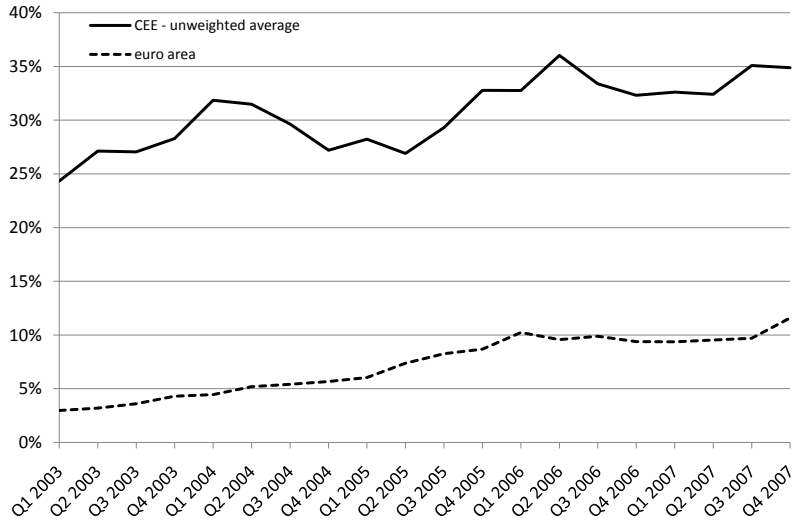
	Number of banks (foreign-owned)			*Asset share of foreign-owned banks (%)*			*Asset share of state-owned banks (%)*		
	1999	2003	2007	1999	2003	2007	1999	2003	2007
Czech Republic	42(27)	35 (26)	37 (29)	38.4	86.3	84.8	41.2	3.0	2.4
Hungary	43(29)	38 (29)	40 (27)	61.5	83.5	64.2	7.8	7.4	3.7
Slovakia	23(10)	21 (16)	26 (15)	24.1	96.3	99.0	50.7	1.5	1.0
Slovenia	31(5)	22 (6)	27 (11)	4.9	18.9	28.8	42.2	12.8	14.4
Poland	77(39)	58 (46)	64 (54)	49.3	71.5	75.5	24.9	25.8	19.5
Croatia	53(13)	42 (19)	35 (16)	40.3	91.0	90.4	39.8	3.4	4.7
Bulgaria	34(22)	35 (25)	29 (21)	42.8	82.7	82.3	50.5	2.5	2.1
Romania	34(19)	30 (21)	31 (26)	43.6	54.8	87.3	50.3	40.6	5.7
Estonia	7(3)	7 (4)	15 (13)	89.8	97.5	98.8	7.9	0.0	0.0
Latvia	23(12)	23 (10)	25 (14)	74.0	53.0	63.8	2.6	4.1	4.2
Lithuania	13(4)	13 (7)	14 (6)	37.1	95.6	91.7	41.9	0.0	0.0

Source: EBRD (2009)

Private credit to GDP levels were above the pace of the euro area, albeit the absolute levels remained relatively low. In 2003-2007 credit to private sector rose significantly faster than in case of the euro area. The credit dynamics in the region reached the highest pace in mid-2006 (Figure 2.1).

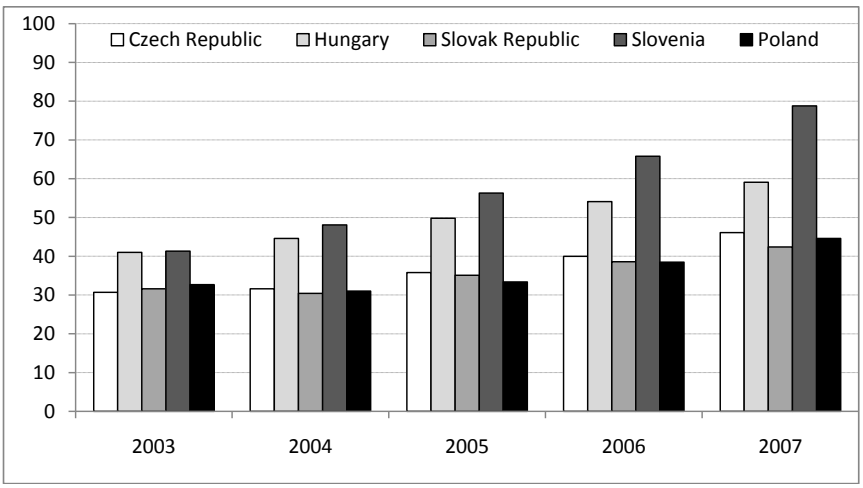
Considering the absolute values, credit in CEE was still below the levels of developed economies: euro area private credit persistently amounted to more than 100% of GDP. Figure 2.2 illustrates relative low levels of the private credit-to-GDP in CEE. One can observe clear differences among Central (CEE-5), Baltic (BE-3) and South-Eastern (SE-3) European economies.

Figure 2.1: Private credit growth 2003-2007: CEE vs. euro area

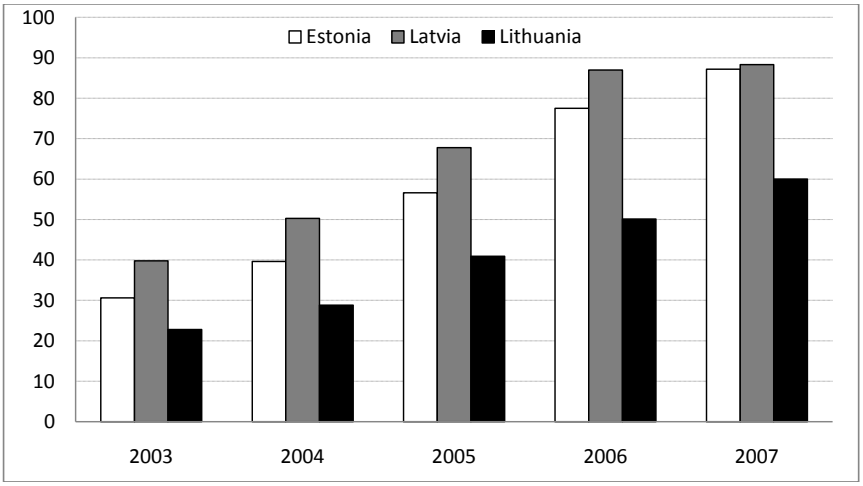


Source: ECB, IFS IMF

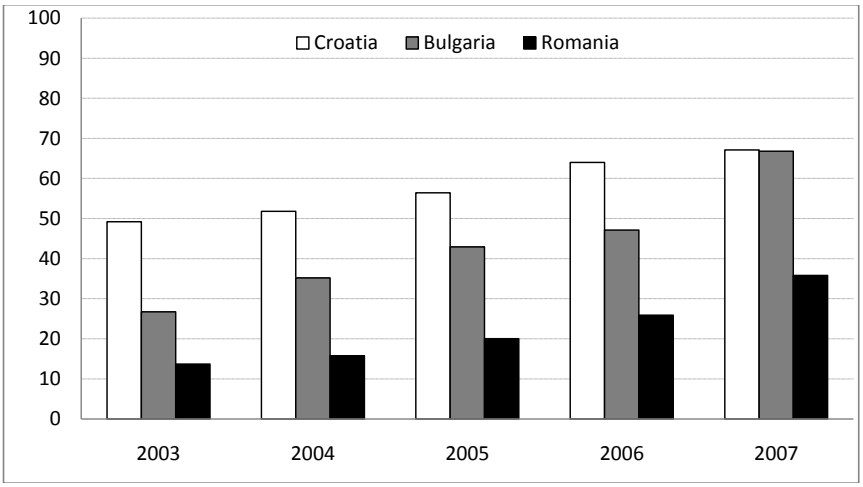
Figure 2.2: Private Credit Growth to GDP (2003-2007)



(a) CEE-5



(b) BE-3

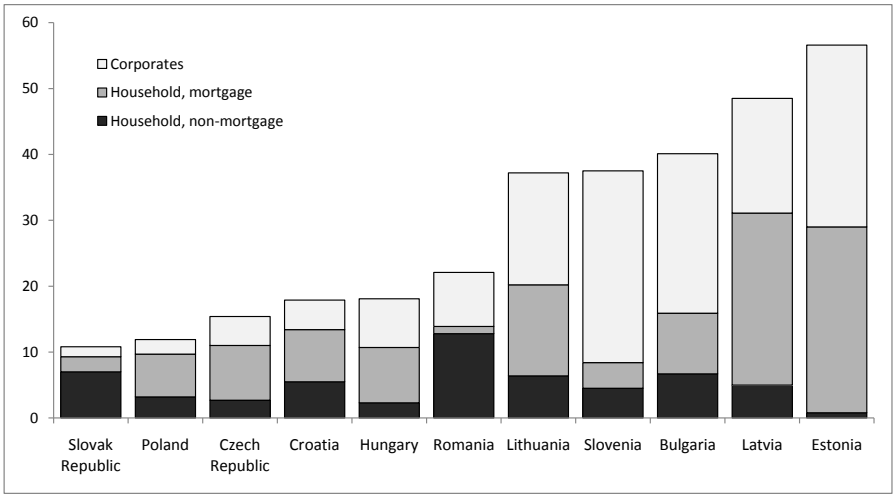


(c) SE-3

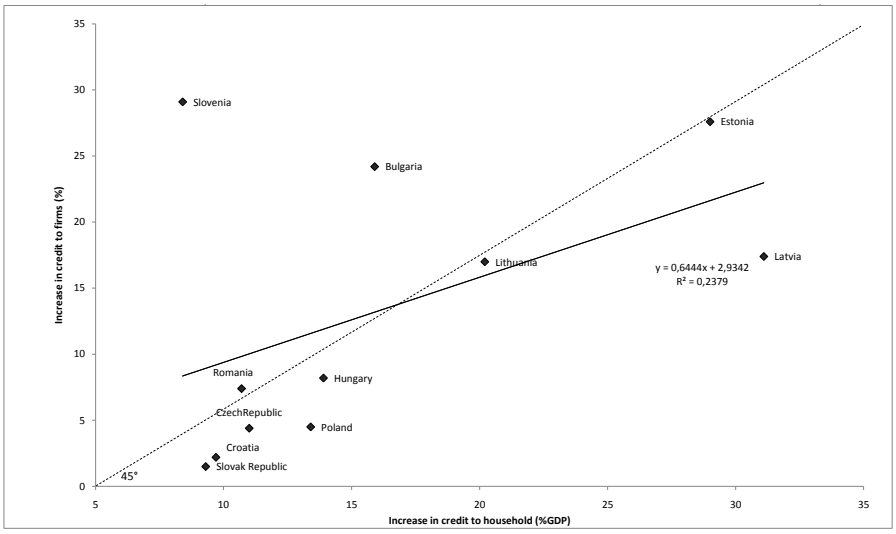
Source: EBRD (2009)

Credit growth was driven by both households and corporates. Decomposition of the private credit growth into households and corporates (Figure 2.3a) suggests that the actual origin of the credit demand was fairly country specific. The corporates absorbed from 14% in Slovakia up to 78% in Slovenia of total private credit. Furthermore, data reveal that corporate credit change is positively correlated with total change in private credit. Looking at the case of households, the most significant portion of the loans are mortgages. The most palpable example is Estonia, the country with the largest domestic credit per GDP, where mortgages amount to 97% of household loans and 51% of total loans.

Figure 2.3: Household vs. Corporate Sector (2003-2007)



(a) Change in private credit to GDP



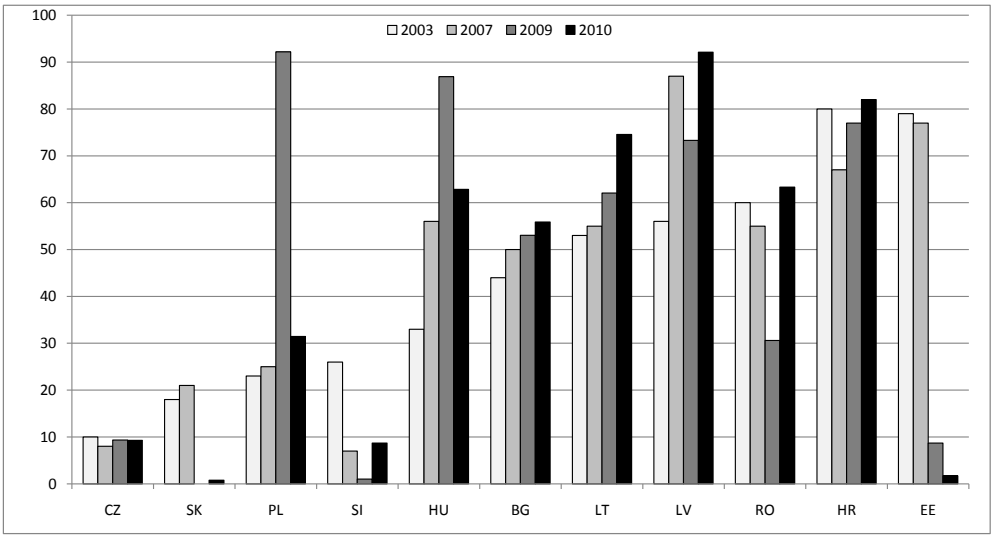
(b) Change in credit to firms vs. households

Source: EBRD (2009)

Earlier findings (Enoch & Ötker-Robe 2007) concluded that private credit used to be driven by households. When extending the analysis until 2007, Figure 2.3b shows that this is no longer the case and that the private credit growth does not have a single-factor engine. In Lithuania and Estonia, the growth pace was triggered almost equally by both households and firms.

In most countries, foreign currency denominated loans were a very significant component of the credit growth. Even though the amount of FX loans varies substantially, the phenomenon is quite widespread. As of mid-2007 it appeared 7 out of 11 CEE economies. The exceptions are the Czech Republic and Poland. Cases of Slovakia and Slovenia should be treated separately as both countries underwent the euro adoption. In case of Slovakia, however, FX loans had not contributed significantly to the total loans (20%). Right before the currency conversion, the share of FX loans in Slovenia was 65% (predominantly denominated in euro).

Figure 2.4: Foreign currency loans (% of total loans to the private sector)



Source: Zumer *et al.* (2009) and national central banks

Cross-border (direct) lending channel was very relevant in a number of countries. Direct lending poses substantial limit on effectiveness of domestic policy measures to dampen the credit dynamics. Table 2.2 illustrates the development of foreign claims in CEE. Total foreign claims consist of cross-border claims and local claims on foreign affiliates' in all currencies. This

is an important distinction that allows us to see that besides activities of local subsidiaries, many countries also faced direct foreign borrowing. Cross-border credit was profound mainly in BE-3 and SE-3 and Hungary while rest of the CEE-5 economies show higher portion of the claims of foreign affiliates. The cross-border channel can represent serious troubles to domestic policymakers as they are unable to control the credit development and domestic agents are obtaining credit directly from abroad.

Table 2.2: Foreign claims (in USD bn, always end of the period)

Country	*Total foreign claims*			*Cross-border claims*			*Local claims*		
	2005	2008	2010	2005	2008	2010	2005	2008	2010
CEE-5									
Czech Republic	85.1	164.0	182.7	26.9	49.6	42.3	58.2	114.4	140.4
Slovakia	33.9	72.6	64.7	7.8	21.4	14.0	26.1	51.2	50.7
Slovenia	14.9	41.8	35.5	11.8	23.9	17.9	3.2	17.9	17.6
Hungary	72.5	136.3	116.8	36.1	66.1	57.2	36.4	70.1	59.6
Poland	103.5	239.5	293.1	32.4	63.7	82.7	71.1	175.8	210.4
SE-3									
Bulgaria	9.4	31.7	34.4	3.5	11.9	12.1	6.0	19.8	22.3
Croatia	38.0	89.6	73.4	16.7	41.0	29.0	21.3	48.6	44.4
Romania	25.8	107.5	106.6	11.8	42.2	38.8	14.0	65.3	67.8
BE-3									
Estonia	16.5	28.9	20.6	11.0	15.1	8.4	5.5	13.9	12.1
Latvia	9.9	30.4	24.1	5.1	8.4	7.3	4.7	22.0	16.8
Lithuania	11.1	26.9	24.4	8.8	13.8	14.8	2.3	13.1	9.6

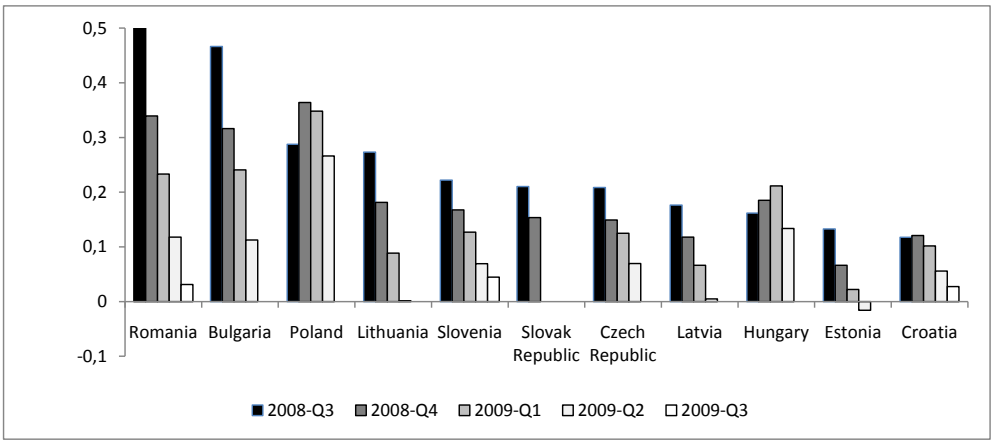
Source: BIS

After the financial turmoil in the last quarter of 2008, the credit growth suddenly turned into a credit crunch. Yet the downturn reflected also country and region specific factors. The slowdown in credit growth occurred in line with the global downturn. The crunch was especially strong in the economies where credit growth was funded by the capital inflows. Foreign mother banks, which were confronted with liquidity and capital shortages, came under severe liquidity pressure and saw themselves forced to stop new lending or even deleverage Bakker & Gulde (2010).

Furthermore, country and region specific factors also contributed to the slowdown: extending domestic and regional imbalances, followed by a collapse of domestic demand and correction in the housing market in a few countries Zumer *et al.* (2009). On the top of that, given the excessive FX denominated borrowing, credit developments were adversely affected by the exchange rate

depreciation (where applicable by the exchange rate framework and existence of FX lending phenomenon). The thesis will however primarily focus on the period prior to the actual credit crunch.

Figure 2.5: Private credit growth 2008-Q3 to 2009-Q3



Source: Zumer *et al.* (2009) and national central banks

2.2 Causes of the credit growth

Understanding the causes of the rapid credit growth is a crucial premise when selecting viable policy instruments to restore the equilibrium levels. There are a number of rather eclectic methods to approach the stimuli of credit dynamics. To address the issue in a clean and simple way, the paper follows the division into supply and demand factors suggested by Enoch & Ötker-Robe (2007). Nevertheless, even in this approach we cannot fully divide some factors since they (by nature) stimulate both supply and demand side of the credit growth.

Demand factors: As economy develops, credit usually rises more quickly than GDP. This phenomenon is known as financial deepening. Level of financial intermediation moves in tandem with the level of development of an economy (IMF 2004)[3]. Thus higher confidence in domestic economy, higher incomes and rise in demand helped to fuel demand for private loans. Optimistic expectations about the future stemmed from the EU accession prospects and further convergence. Within the researched period all CEE economies but Croatia eventually joined the EU. Entry of foreign-owned banks did further strengthen confidence in the banking sector.

Vast part of literature attributes the most important role to the catching-up process that spurred from low financial deepening in the region. Borrowing costs were eased as interest rates declined. In addition, pegged or managed exchange rate regimes were source of stable and predictable exchange rate developments that made FX-denominating loans a choice.

In mortgage market, rising prices of real estates promoted the demand for housing loans. On the top of that, much has been achieved by direct policies. For instance tax deductibility of mortgage payments, subsidies or government guarantees made certain type of loans even more attractive to the borrowers.

Supply factors: are mostly based on economic transition and the above mentioned catching-up process: privatization and deregulation of financial sector attracted arrival of foreign banks into the region. Foreign-owned banks brought better risk management practices and access to funding from parent banks

[3]Causality between the financial deepening and economic growth has been address by a number of research papers from both theoretical and empirical point of view. Most papers conclude that it is that financial deepening affects general economic growth rather than the other way round. Nonetheless, questions remain about the robustness of the results (see IMF (2004) for detailed literature overview).

(Enoch & Ötker-Robe 2007). Larger number of functioning banks improved competition; hence narrowed the spreads and introduced new products. Overall macroeconomic stabilization did not only mirror in the appetite for borrowing, but also into the appetite for lending. This was mainly due to the improved perception of creditworthiness of potential borrowers.

As country risk premiums fell and business sector conditions upgraded, countries attracted large capital inflows. Cumulative capital inflows during 2003-07 ranged between 33% of 2003 GDP in the Czech Republic and 192% of 2003 GDP in Bulgaria (Bakker & Gulde 2010). Authors also stress that the size of the capital inflows thus exceeded those pre-crisis Asia. Capital levels were already high in 2003 and further increases yet extended huge differences among CEE countries. Large capital inflows were caused by a combination of purely regional / domestic conditions (reforms, low income levels) and global environment (abundant liquidity, low risk aversion, low interest rates). Global search for the yield led to surge in capital inflows in all emerging world. Bakker & Gulde (2010) emphasize that CEE countries with larger influx of capital from Western banks (e.g. Baltic states, Bulgaria) also had a larger increase in the private sector credit-to-GDP ratio than countries where the influx was small (Slovak Republic).

On the top of that, with European integration, EU structural funds served as another new source of co-financing (namely in Latvia and Lithuania).

2.3 Literature Overview: How much is too much?

Credit growth is an extremely demanding concept to address. One of the reasons behind the difficulty is that there is no correct answer to a simple question: How much credit growth is too much? Private credit growth is inherently beneficial and politically popular. Revivals of credit growth can be seen as signs of a healthy banking system and returning confidence to the economy (Enoch & Ötker-Robe 2007, p.5). And yet, 75% of the credit booms in emerging market economies are associated with a banking crisis, while 85 % of the booms coincided with currency crises (IMF 2004).

IMF (2004) divides credit growth into three separate components: *a*) *trend* (reflects financial deepening), *b*) *cycle* (normal cyclical upturns), *c*) *boom* (excessive cyclical movements). Special emphasis is given to the latter component.

Excessive credit expansion (boom) is unsustainable and potentially risky part of the credit growth.[4]

Nonetheless, it is not an easy task to identify excessive credit boom. There is no well-accepted threshold that would allow to conclude that the growth is excessive. On the side of quantification, much has been achieved in recent years (Enoch & Ötker-Robe 2007). In particular, three main methodologies have been widely used in order to determine soundness of the credit developments: *a*) "speed limits", *b*) time series analysis, and *c*) econometric models that try to derive equilibrium level of credit subject to macroeconomic fundamentals.

"Speed limit" is the most straightforward, albeit the least applied approach. Speed limit is an arbitrary set threshold. Provided the credit expansion exceeds the limit, credit growth is considered as excessive. This method was used in Duenwald *et al.* (2007) that analyzes credit developments in Bulgaria, Romania and Ukraine or Coudert & Pouvelle (2010) for a wider group of Central and Eastern European economies.

Time Series Analysis helps to identify a trend in credit developments. The estimated trend is considered as an equilibrium deepening of the financial sector. The credit boom is then defined as a credit growth that exceeds a certain threshold around the trend (Kiss *et al.* 2006, p.4).

Most often the analysis is performed by applying Hodrick-Prescott filter, i.e. filter that generates a smooth long-term trend of given series. Penalty parameter for annual series λ is usually set to 100 as opposed to rolling H-P filter with λ equal to 1000. The rationale behind such a quantification is that rolling H-P filter would distort the characterization of credit cycles by shifting them over time (IMF 2004).

In this respect, it is also viable to note that new Basel III proposes application of credit-to-GDP as a calibration indicator for countercyclical capital buffer. Here buffer is indicated by gap between ratio and trend. Trend is obtained through HP by setting λ to 400,000 as it captures the long-term trend

[4]One important mechanism that can lead to a credit growth is the financial accelerator. Financial accelerator arises from financial market imperfections that result from *a*) information asymmetries (lenders vs. borrowers, regulatory issues or agency problems that lead to the implementation of lending policies by some banks that may be affected by others) *b*) institutional shortcomings (explicit or implicit government guarantees, lack of credible economic policies), or *c*) perverse incentives facing borrowers and lenders which imply that borrowers may face constraints (IMF 2004).

in the behavior of the credit-to-GDP ratio in each jurisdiction (BIS 2010a, BIS 2010b).

More importantly, H-P can provide sensible solutions only when long time series data are used. It is generally agreed that the minimum time span for meaningful output is two decades for yearly data. Furthermore, there is another obstacle in case of emerging economies: structural breaks caused by transition may contribute to significant bias of the results (Boissay *et al.* 2007)[5].

Econometric models deriving equilibrium level of credit-to-GDP ratio subject to macroeconomic fundamentals are the most popular method in case of the CEE region. Even though literature recognizes different estimation techniques, different sets of countries and variables, there is a crucial shared characteristics: approach to set a benchmark.

All of the papers assume that the financial depth in the region remained comparatively low and also that the period is still too short to draw any meaningful results. In order to avoid biasness of econometric estimates, most papers use estimation (of different groups) of developed countries for longer periods. Developed countries in long run are perceived as a natural benchmark as CEE are believed to converge to their level. To be more specific papers usually work either with old EU member states (justified by EU catching-up process), developed economies in general (Boissay *et al.* 2007) or small OECD countries (after careful analysis of a variety of panels Égert *et al.* 2006, later Backé *et al.* 2007).

The entire process can be described as follows. Firstly in-sample panels (developed countries) provide results regarding the influence of major macroeconomic determinants to private credit-to-GDP levels. Secondly, out-of-sample analysis is performed. The estimates are used to obtain the equilibrium level of private credit-to-GDP in CEE countries. Thirdly, the out-of-sample results are compared with actual data, deviations are identified and discussed.

[5]For illustration Nakonthab & Subhawasdikul (2003) present an analysis for Thailand by researching the components of the credit developments for the period of 50 years (1951-2002).

Table 2.3: Literature Overview

		Variables	
Authors	Methodology	Dependent	Explanatory
Boissay *et al.* (2007)	VECM on aggregated eurozone data	Private Credit (%GDP)	GDP per capita, real int. rate, inflation.
Brzoza-Brzezina (2005)	VECM for individual countries	Real loans to private sector	Real GDP, real int. rates.
Kiss *et al.* (2006)	Pooled mean group estimator (PMG)	Private Credit (%GDP)	PPP-based GDP per capita, real interest rate, inflation.
Égert *et al.* (2006)	Pooled OLS FE OLS MGE	Private Credit (%GDP)	PPP-based GDP, government credit, short and long-term nominal int. rate, inflation, house prices, interest rate spread, credit registries.
later revisited in			
Backé *et al.* (2007) Zumer *et al.* (2009)	Pooled OLS	Private Credit (%GDP)	PPP-based GDP, government credit, long-term int. rate, inflation, interest rate spread.

Boissay et al. (2007) deals with credit developments in 8 CEE countries[6] throughout the years 1996-2004. The selected period is fairly difficult to analyze because of its turbulent character (notably the years 1996-1998).[7] As a result part of the analysis is conducted only on the data from 1999 onwards.

The results indicate that excessive credit growth occurred in the countries with fixed exchange rate regimes, i.e. three Baltic states and Bulgaria. In case of Hungary and Croatia the credit growth can also be considered as excessive, however to a lesser extend. Authors also disaggregated credit data by currency. Here the results suggest that excessive borrowing can be the case in both domestic and foreign currency.

[6]Bulgaria, Romania, Slovenia, Croatia, Hungary, Latvia, Lithuania and Estonia

[7]The total outstanding loans-to-GDP remained under 40% in all countries. However, the credit developments were very country specific. The worst situation, severe banking and macroeconomic crisis, was witnessed the case of Bulgaria.

Brzoza-Brzezina (2005) analyses the potential for lending booms in three biggest CEE economies: Hungary, Poland and the Czech Republic. The main idea of the research is to compare the effects of the process of European integration and the possible upcoming Euro adoption. For this purpose author chooses to compare given CEE countries with Greece, Portugal and Ireland. The selection is justified by saying that these economies can be seen as lower-income, catching-up countries where "although annual credit growth rates exceeded 20-30 % in real terms, banking sectors have not yet been adversely affected" (Brzoza-Brzezina 2005, p.2). When looking at the countries today, one may start to question the selection of the countries as natural benchmark.

Again, paper works with vector error correction model, Brzoza-Brzezina (2005) follows earlier methodology used by Calza *et al.* (2001), Calza *et al.* (2003) and Hoffman (2001), i.e. real loans in private sector subject to real GDP and real interest rate [8]. Findings show strong increases in private credit in Poland and Hungary, while the results for the Czech Republic remain low. Nonetheless, the paper concludes that the credit developments are still substantially low compared to the experiences of Ireland and Portugal.

Kiss et al. (2006) use instrumental variable estimation technique to identify periods of boom (following the definition of IMF 2004) in 10 new EU member states. Old eurozone countries are used as a benchmark (for a period 1980-2003). The paper works with the premise that in the long run financial markets shall be fully integrated. Authors chose pool mean group estimator (PMG) as it can be applied for models with rich and heterogeneous dynamics. Besides aggregated data, the paper also deals with sectoral estimation - it breaks down into household and corporates for a shorter period of 1995-2002.

The results suggest that all explanatory variables (PPP-based GDP per capita, real interest rate and infation rate) are empirically significant. However, nearly half of the cross-section variance remained unexplained by the model. Out-of-sample estimations shows that large credit growth observed in the last decade in the countries can justified by fundamentals. Nonetheless, credit growth was significantly faster than what could be justified along the equilibrium path.

[8] Calza *et al.* (2001), Calza *et al.* (2003) and Hoffman (2001) estimated the effects of the macroeconomic fundamentals on real loans in euro area countries. The specific selection of explanatory variables may slightly vary: Calza *et al.* (2001) concerns with GDP and real interest rates whereas later Calza *et al.* (2003) introduced also inflation, Hoffman (2001) besides standard variables also tests the effect of housing prices.

In general, credit-to-GDP ratios are below levels justified by fundamentals (initial undershooting). Latvia and Estonia can be considered as potentially the most risky, having credit growth beyond any plausible adjustment rate.[9] What is more, out-of-sample calculations indicate that in the countries where risk of a credit boom is non-negligible, it is dominantly the household indebtedness that produces faster than equilibrium dynamics (Kiss *et al.* 2006).

Égert et al. (2006) and later versions[10] greatly contributed to the literature on credit developments for a number of reasons. First, the list of CEE countries was expanded to eleven (the same sample as used in this thesis). This is the largest CEE sample in the literature testing equilibrium credit growth in CEE. Second, the first publication Égert *et al.* (2006) carefully tested a number of possible benchmark country groups (emerging markets, small emerging markets, all OECD, small OECD). After detailed discussion of significance and signs of estimated parameters, small OECD countries were selected. Third, authors developed eight models using alternative variables which served as robustness checks. The main model regressed private sector credit-to-GDP (C^P) on five explanatory macro variables: GDP per capita in purchasing power parities ($CAPITA$), bank credit to public sector as a percentage of GDP, (C^G), long-term nominal interest rate ($i^{lending}$), inflation measures by PPI index (p^{PPI}) and the spread between lending and deposit rate as a proxy to financial sector liberalization ($spread$):

$$C^P = f(CAPITA, C^G, i^{lending}, p^{PPI}, spread) \tag{2.1}$$

First results (as of the end of 2004) suggested that overall private credit-to-GDP ratios tended to approach equilibrium levels. Derived range of deviation (error margin) was however too large to clearly conclude whether the credit to GDP is overshooting the equilibrium level or not. As of the end of 2004, findings suggest that given the error margin only Croatia could have reached the equilibrium level. Credit levels in other countries were still below the equilibrium.

Backé *et al.* (2007) revised the earlier published works by extending the period until 2006. The updated findings showed that the private sector level rose

[9] As for other country specific results, Hungary, Lithuania and Slovenia observed fast credit growth but yet it can be explained by convergence. Czech Republic, Poland and Slovakia had no signs at all of excessive credit growth.

[10] Backé *et al.* (2007) and Zumer *et al.* (2009)

a little more in Bulgaria, Estonia, Hungary and Slovenia. The most dramatic upward movement occurred in Croatia and Latvia. Furthermore, Backé *et al.* (2007) pointed that the latter two countries could have had future overshooting propensities.

Zumer *et al.* (2009) revealed further increase of private credit to GDP. The most pronounced results were in all Baltic economies, Hungary and Romania and since 2006 also Poland.

2.4 Updated results for CEE

2.4.1 Methodology

In the spirit of Égert *et al.* (2006) and later publications (Backé *et al.* 2007 and Zumer *et al.* 2009) we attempted to replicate the model. The shared idea is the notion of behavioral equilibrium, i.e. the definition of equilibrium level of private-sector credit as a level that is justified by economic fundamentals. Deviation from the equilibrium can occur either in form of "undershooting" or "overshooting". Since the underlying economies are countries in transition, we assume strong initial "undershooting" that could bias the data as the adjustment takes place. Therefore we work with the same benchmark panel of small OECD countries (in-sample estimation). The fitted values are then used to derive equilibrium levels of private credit-to-GDP for CEE economies and by comparing them with empirical values we obtain deviations from the long-run equilibrium (out-of-sample exercise). The updated results follow the methodology introduced by Égert *et al.* (2006) with some minor modifications. All the modifications to the original methodology are explained and justified as follows.

We assume the same benchmark, set of in-sample countries, that is small OECD economies[11]. Our in-sample estimation uses shorter but more consistent period of 25 years (from 1980-Q1 to 2004-Q4).[12] Having quarterly data, we operate with exactly 100 observations per country. Data treatment follows

[11]The sample naturally consists only of the non-CEE small OECD economies: Austria, Australia, Belgium, Canada, Denmark, Finland, Greece, Ireland, the Netherlands, New Zealand, Norway, Portugal, Spain and Sweden.

[12]The original sample data began between 1975 and 1980 causing the dataset to "unbalanced, as the length of the individual data series depended largely on data availability" (Égert *et al.* 2006). In our model we opt for a single specific start date: 1980-Q1 where all the listed countries already have the data publicly available. As a result our dataset is strongly balanced.

the original methodology. In particular: data have been obtained form International Financial Statistics of the IMF. In case the data are not quarterly quoted, they have been linearly interpolated from annual figures. All data are transformed into natural logarithms.

The most important divergence from Égert *et al.* (2006) is the definition of the dependent variable: private credit to GDP (C^P). Égert *et al.* (2006) define bank credit to the private sector as a summation of *claims on other non-financial corporations and other resident sectors (households/non-profits)* and *claims on other financial corporations*[13]. However, the IMF stresses that *claims on other financial corporations* (line 22g) equals claims on other financial corporations (could be either public or private). Note that if a country has had a banking crisis and has set up a bank restructuring agency to take on those bad debts, even if it is publicly owned, it would be included there. That would be one potential problem in the analysis depending on the size of the public non-deposit taking financial sector. As result, we operate only with *claims on other non-financial corporations and other resident sectors (households/non-profits).*

2.4.2 In-sample results

Private sector credit-to-GDP (C^P) was regressed on five explanatory variables: GDP per capita in purchasing power parities ($CAPITA$), bank credit to public sector as a percentage of GDP, (C^G), long-term nominal interest rate ($i^{lending}$), inflation measures by PPI index (p^{PPI}) and the spread between lending and deposit rate as a proxy to financial sector liberalization ($spread$). Table 2.4 illustrates the estimation of coefficients for fixed-effects model.

The original paper Égert *et al.* (2006) tested different estimation method and concluded fixed effects model as the most appropriate. Further extensions of the paper (Backé *et al.* 2007 and Zumer *et al.* 2009) operate only with FE OLS. Since we analyze long-term relationship between the data, we need to make sure the private credit-to-GDP is cointegrated with the explanatory variables. We can confirm our variables to be cointegrated. On the other hand, when testing for stationarity we found out the data to be I(1) processes - they are stationary in first differences. The detailed test statistics for both stationarity and cointegration are provided in Appendix A.

The estimation results correspond with expected signs of explanatory vari-

[13]International Financial Statistics of the IMF denotes them as lines 22d and 22g respectively.

Table 2.4: In-sample estimation results for OECD countries 1980-Q1 - 2004-Q4.
C^P= f(CAPITA,C^G,$i^{lending}$,p^{PPI},spread)

Variable	**Coefficient**	**(Std. Err.)**	
Intercept	-5.525	(0.557)	***
capita	0.535	(0.053)	***
cg	-0.093	(0.016)	***
i_lending	-0.294	(0.029)	***
p_ppi	-0.543	(0.215)	**
spread	-0.034	(0.018)	*
R^2	0.743	Adjusted R^2	0.739
$F(17, 1141)$	193.583	P-value(F)	0.000

Note *, ** and *** indicate statistical significance at the 10%, 5% and 1% significance level, respectively.

ables and all are statistically significant at least at 10% ($CAPITA$, C^G and $i^{lending}$ are significant at 1% and p^{PPI} is at 5% significance level)[14]. Credit to public sector (C^G), nominal lending rates ($i^{lending}$), inflation (p^{PPI}) and ($spread$) negatively influence private sector credit-to-GDP. On the other hand GDP per capita ($CAPITA$) and private credit-to-GDP are positively related.

The original paper does not provide us with information about estimated intercept, its significance or the coefficient of determination. Based on our results, adjusted R-squared equals to 74.25% all constant term proved to be significant at the 1% significance. The intercept estimation will be discussed in greater detail in the out-of sample fitting.

2.4.3 Out-of-sample results

Next, the estimated coefficients are used to derive the equilibrium levels of credit-to-GDP for CEE. The key assumption here is that there is long-run parameter homogeneity between two country panels (Zumer *et al.* 2009). As a matter of fact the approach is a double out-of-sample exercise: it works with different set of countries and different time period (1993-Q1 to 2008-Q4). The rationale behind the different time period is twofold. First, due to data availability we start between 1993-Q1 and 1997-Q4. Second, the out-of sample time period is deliberately extended until the verge of financial turmoil (2008-

[14]The original data estimation were not statistically significant for inflation, p^{PPI} whereas in our case the variable is significant at the 5%significance.

Q4) without extending the in-sample timespan. This is due to the fact that from global point of view, years directly prior to the crisis (2005-2007) can be considered as a period of exuberance and could have probably introduced bias (overestimation) to the long-term equilibrium credit levels.

In order to compare the fitted long-term equilibrium levels, we need to address the issue of country-specific constants. Since the first model publication Égert *et al.* (2005) acknowledge that the short time period and the fact that this period can be classified as a transition period for CEE, one cannot derive directly country-specific constants. That is why, Égert *et al.* (2005) introduce the median level constant term (from in-sample regression) and an oscillation range. There are a number of ways to construct the oscillation range (subject to 95% confidence range, multiples of standard deviation, max-min etc.). Égert *et al.* (2005) proposes to use the maximum and minimum value from in-sample constant as the safest bet. Since the min and max constants are not equally distant from the mean, the oscillation range is not symmetric. In detail, the country specific constants is slightly negatively skewed.

2.4.4 Evaluation of results

Figure 2.6 illustrates deviations of actual private sector-to-GDP levels from long-run equilibriums. All the countries recently witnessed uprising tendencies of the private credit. The oscillation range introduces uncertainty to the final results. Nonetheless, some patterns in credit developments can be observed.

All the economies reached long-term equilibrium at least by the upper estimate. What is more, in case of Latvia, Estonia, Croatia, Bulgaria and partly Hungary even the lower estimate exceeded the long-run equilibrium. These cases of overshooting are largely in accordance with general consensus and stylized facts about the credit boom in the region. The oscillation ranges of Zumer *et al.* (2009) are slightly shifted down the y axis. Therefore Zumer *et al.* (2009) does not identify any economy to have entire range above the equilibrium, yet they consider Bulgaria, Latvia and Estonia to be very close.

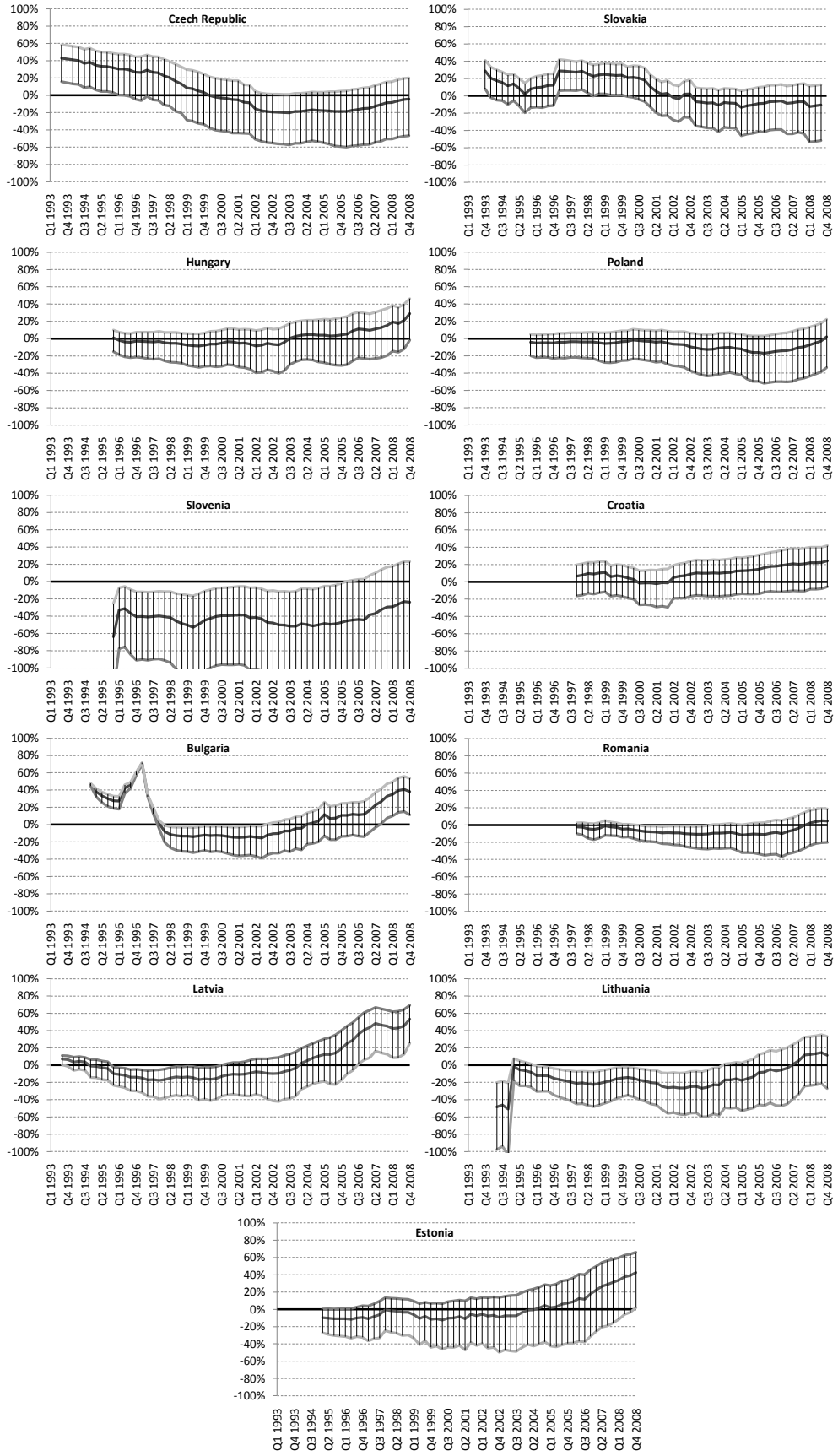
Most of the countries seem to have approached the equilibrium level and their oscillation range is fairly spread around the zero deviation level. In particular, Czech Republic and Slovakia have medium levels slightly undershooted but very close to equilibrium. Also, Poland and Romania are moving fairly close to the equilibrium, but having a constantly rising trend, their mean de-

viations turned positive during the year 2008. Anyway, as the time series stop at the end of 2008 we are not able to examine the issues further.

Compared to the original model two countries differ significantly: Slovenia and Romania. In case of Slovenia we derived a very large range of oscillation that is strongly biased to lower values. This was largely due to the fact that Slovenian macro data are very strong. Hence when comparing the actual (but based on the stylized facts quite elevated) level of private credit to GDP with fundamentally-derived ones, the results suggest possible very large undershooting. In this case, the best treatment would be to obtain different country specific constant estimation that could reach to more straightforward conclusion.

The issue of Romania varies from Zumer *et al.* (2009) because of the different definition of private credit to GDP that was discussed before. The reason is that we do not operate with line 22g of IFS *claims on other financial corporations* but only with *claims on other non-financial corporations and other resident sectors (households/non-profits)*. That is why our results in Romania does not exhibit as pronounced downward and consequent upward shifts since 2005 as in Zumer *et al.* (2009) but they have smoother uprising trend.

Figure 2.6: Deviations of actual from long-run equilibrium private sector-to-GDP levels 1993-Q1 to 2008-Q4



Negative values: observed private sector-to-GDP ratio is smaller that fundamentally-predicted one (undershooting). Positive values: observed private sector-to-GDP ratio is larger that fundamentals (overshooting).

Chapter 3

How to tame the credit boom?

Policy responses have been the subject of much controversy for a number of reasons. Prior to the credit crunch, the global view favored the approach of benign neglect rather than a more proactive policy stance. Justifications were twofold. First, as has been pointed out in the previous chapter, it is a demanding task to clearly identify excessive credit expansion that is not in line with macroeconomic fundamentals. Second, any measure entails costs and distortions. And yet, not all credit booms are followed by financial crisis or poor macroeconomic performance. As a result, introduction of proactive measures is a challenging task. Its ex ante valuation, indeed.

However, even upon deciding to act, the task is not about to become any easier as more questions emerge. What policy tools do policymakers actually have at their disposal? How powerful they are? What are the limitations? Crowe *et al.* (2011) stress that there is "no silver bullet" among the policy options. Each policy introduces costs and distortions and its effectiveness is limited by loopholes and implementation problems. Broad reaching measures (e.g. monetary policy rates) are more difficult to circumvent, and hence potentially more effective, but will typically involve greater cost. On the other hand, more targeted measures (e.g. specific macroprudential measures) may limit costs but will be challenged by loopholes, jeopardizing efficiency (Crowe *et al.* 2011).

Needless to say, one must also account for the interactions across the range of the tools, their complementaries as well as potential conflicts. At last, every economy is unique in its distinctive characteristics and institutions that significantly influence feasibilities of each measure and possible trade-offs.

Rapid credit growth poses both opportunities and challenges to economic

policymakers. The dilemma is how to successfully avoid overheating pressures or financial crisis without hindering demand and economic growth. Before discussing set of policy instruments central authorities have in hand to fight the negative effects of credit growth, it is viable to address the issue of riskiness of the credit growth.

3.1 Risks

Table 3.1 summarizes the main risks associated with credit growth. Hilbers *et al.* (2005) list the set of potential risks based on the various features of credit developments. In other words, risks stem from the very nature of the credit growth; notably its pace (speed), main providers of credit (foreign versus domestic institutions, banks versus other financial institutions), main borrowers (households versus corporate sector), specific sectoral loan concentration or composition of credit (mortgages, durable consumer goods, investments etc.), currency denomination, maturity of loans and sources of credit. Two most frequently identified types of risk are credit and macroeconomic risks. Furthermore, by nature the risks can often be causally linked. This may be the case especially in period of a very rapid credit boom.

Macroeconomic risk is a thread to macroeconomic stability. Emergence or worsening of economic imbalances can result from a number of aspects: high speed of credit growth, concentration and strategy of the main providers of credit, sectoral composition of loans etc. Based on IMF (2004), 70% of credit booms coincide with either investment or consumption boom in emerging market. As credit boom fuels domestic demand, it created pressure on prices in asset, good and labor markets. Firstly, purely domestic impact may come to mind: inflationary pressures. Secondly, higher domestic demand also leaks out through demand for foreign goods (imports), thus deteriorating trade balance. As a result, country may face a serious issues ranging form loss of competitiveness, currency appreciation to large current account deficits. Provided sectoral composition of loans is unbalanced, credit booms may besides inflation result also in swift upswing of house prices or fuel asset bubbles.

Credit risk, on the other hand, is primarily concerned with deteriorating quality of loans. Again reasons are manifold, from aggressive risk strategies by main providers of credit, insufficient loan assessment, weak diversification of loans to lack of expertise in monitoring (Table 3.1). Furthermore, during credit booms, assessment may also be biased by currently strong economic situ-

Table 3.1: Key Risks Associated with Credit Growth

Aspects	*Type of Risk*	*Notes*
Speed	Credit risk	Inadequate loan assessment, ability to monitor and assess risks
	Macro risks	
Main providers	Credit risk	Aggressive lending strategies
	Macro risks	
Main borrowers	Credit risk	Corporate loans sensitive to the economic situation Consumer loans sensitive to collateral values
	Macro risks	Likely impact of loans on the current account
	Market risks	Sensitivity to economic activity and price changes
Sectoral composition	Credit risk	Concentration, collateral values for mortgages etc.
	Macro risks	Impact on the current account in the case of consumer/investment loans
	Market risks	Sensitivity to real estate prices
Currency composition	Foreign exchange risk	Direct exposure (through net open positions of banks) Indirect exposure (via borrowers)
Maturity	Maturity/liquidity risks	Longer-term loans financed through shorter-term borrowing
Sources of credit	Foreign exchange risk	Loans funded by bank borrowing
	Maturity risks	When liabilities short-term, assets longer-term
	Macro risks	From exposure to market sentiment

Source: Hilbers *et al.* (2005)

ation (corporate sector) and rising values in underlying collateral (households). Duenwald *et al.* (2007) estimate the likelihood of a banking crisis following a lending boom to be 20%.

Next, foreign exchange risk may be significant especially in case of high share of FX-denominated loans or tendency to borrow from abroad. The FX risk can have either direct or indirect character. Exposures to the direct FX risk then stem from on-lending in domestic currency. On the other hand, exposures to the indirect risk is created by on-lending in foreign currency to unhedged borrowers.

Understanding the nature of the risk (both macroeconomic or financial risks) is crucial in order to focus on the appropriate policy response. As a matter of fact, the risks are often interrelated which requires a package of both macro and prudential tools.

3.2 Macroeconomic measures

3.2.1 Monetary policy

When discussing monetary measures, the most important question to ask is whether the current macroeconomic environment is stabilized or not. Tightening of the monetary conditions can reduce overheating pressures via adversely affecting either demand for loans or liquidity base. As a consequence, credit expansion should slow down and economy may avoid high inflationary pressures or current account deterioration. On the other hand, Crowe *et al.* (2011) emphasize that in case of tranquil macroeconomic environment, monetary policy actions can be too blunt and costly as the interest rate hikes would entail significant costs in terms of output gap and desired inflation rates.

Rise in key policy rates makes borrowing more expensive and reduces demand for loans. Provided monetary transmission mechanism works properly, higher policy rates should be reflected in higher bank lending rates, hence directly impacting the cost of borrowing. Based on country experiences, the most worrisome was the mortgage market. Here higher interest rate payments translate into lower house affordability index.[1] As a result smaller amount of borrowers can qualify for specific loans (Crowe *et al.* 2011).

Interest rate increases pose however many concerns. As interest rates affect entire economy, they shall be used only to address macroeconomic overheating pressures. Second, higher domestic interest rates may adversely affect borrowing structure, for instance shift of borrowing to foreign currency denominated loans. Third, raising interest rates can attract more capital inflows and fuel appreciation pressures. Fourth, the impact may be even more limited in case of fixed/quasi fixed exchange rate regimes and free capital mobility. Fifth, the outcome largely depends on the dependence between long-term (often mortgage) loans and policy rates in that particular economy. Sixth, based on the US sub-prime mortgage loan experience, speculation is not likely to be affected by change in key policy rates (see Crowe *et al.* 2011).

[1] House affordability index is defined as follows

$$HAI = \frac{\text{Median Household Income}}{\text{Qualifying Income for a Mortgage Loan}} \times 100$$

where qualifying income is derived from the monthly payment on the median priced home at the effective mortgage interest rate.

Changes in the reserve requirements (RR) are an extremely strong instrument widely used in CEE during the transition period. Enoch & Ötker-Robe (2007) stress that an increase in RR can be essential in one-off sterilization of excess liquidity or in accommodation of structural changes in demand for reserves. Besides changes in the required level, measures often include also reserve requirements *differentiated* by the currency, type of deposit or broadening the reserve base.

Figure 3.1: Box - Marginal reserve requirements

Marginal reserve requirements (MRR) are special extension of regular reserve requirements. In our set of countries they were used in Bulgaria and Croatia. However, the way of measure design is substantially various and deserves special treatment.

Croatia used the MRR mostly over the period 2004-2006. MRR were introduced on foreign exchange deposits and liabilities by requiring banks to make additional non-interest bearing deposits with the Hrvatska Narodna Banka (HNB) if the foreign liabilities increased over a defined threshold. Over the time MRR evolved and the calculation modified, however they still resemble standard RR in the tax-type nature, in particular reserve requirements differentiated by the currency. Yet the difference is in the marginal character: MRR restrict only new FX liabilities with respect to specific base (in other words only incremental values). Thus, structure of MRR lies somewhere between regular monetary and prudential tools.
The measure was particularly popular because it is directly aimed at FX borrowing and it is relatively easy to implement. One can argue that MRR help reduce financial stability risk as it may give banks an incentive to restructure funding towards more domestic deposit and increase the capitalization levels. On the other hand, circumvention to less-supervised channels can often be the case.

Bulgaria worked with MRR as a measure to reinforce credit ceilings. Bank credit that was in excess of the limit was subject to the marginal reserve requirements. Here marginal requirements were of huge size (starting at 200% and rose higher over time). The marginal character is therefore derived from the ceiling values and can also be seen as penalty deposit rate.

To sum up we will consider Croatian MRR to be close to general RR and Bulgarian to be linked with administrative measures (together with credit ceilings).

However, RR changes have many limitations as they hinder financial intermediation (i.e. RR are perceived as a tax on financial intermediation as they

do not generate interest paid). Possible negative outcomes are lower financial deepening, moving of the banks offshore or in case of subsidiaries higher borrowing form parents[2], banks accepting more risky projects, discrimination of banks vis-à-vis non-banks. As a result, it is seldom used in developed economies. Even if RR are raised in one-off manner, it can under no condition occur on frequent basis. Furthermore, successful implementation depends on particular constraints of monetary regimes (e.g. existence of currency boards or currency unions).

3.2.2 Exchange rate policy

Exchange rate policy measures address the foreign exchange risk of the credit growth. The risk is associated with significant FX-denominated borrowing or/and tendency to borrow from abroad. Furthermore, Hilbers *et al.* (2005) argue the main problem is misperception of FX risks by economic agents. In particular, it is a combination of two factors: seemingly predictable exchange rates and high interest rates differentials that are not consistent with exchange rate regime. As a result it may create misperception of low exchange rate risk and encourage FX-denominated borrowing. Standard macroeconomic toolkit includes increasing exchange rate flexibility and consistent mix of exchange rate and monetary policy.

Increasing the flexibility of exchange rates limits the predictability of exchange rate developments thus may correct for the FX risk underestimation. Hilbers *et al.* (2005) illustrate the successful case of Poland in early 2000s where after authorities increased exchange rate flexibility and allowed for domestic interest rates to narrow (in combination with supervisory tools). As a result economy managed to reduce the amount of FX-denominated loans.

Nevertheless the tool is strictly limited by the nature of exchange rate regime. A few CEE economies operate under pegged exchange rate regimes (currency boards, quasi-currency boards, ERM-II arrangements etc.). However, even in this case policymakers can attempt to maintain consistent mix of exchange rate and monetary policy.

Maintaining consistent mix of exchange rate and monetary policy means keeping domestic interest rates consistent with particular exchange rate regime

[2]Having foreign parent banks and an economy with open capital account, changes in RR may not be effective unless the ability to borrow from the mothers is taken into account (Hilbers *et al.* 2005).

to limit incentive for excessive FX-borrowing or lending. Moreover, the measure should go hand in hand with other macroprudential measures in order to address the structural factors of the system that contribute to high interest margins (e.g. high risk premium, high transaction or operational costs, tax distortions). Hilbers *et al.* (2005) further ague that keeping domestic rates consistent with exchange rate commitment is the first best policy for not-fully flexible exchange rate regimes.

3.2.3 Fiscal policy

Tightening of the fiscal policy may in theory help counter the credit boom. Crowe *et al.* (2011) discusses specific fiscal measures that can hinder one element of the private credit growth - real estate booms: transaction taxes or property taxes. The authors also discuss the potential of the measures in a countercyclical manner. In practice, there are, however, significant caveats to the fiscal approach. First, across CEE economies a fiscal situation is often too tight and there is not much room for further tightening. Second, political and technical problems may greatly complicate the situation. Third, tighter fiscal stance may provide further incentives to circumvent the measure (e.g. via misreporting of property values) and hence it requires further supervisory measures. Fourth, in case of mortgage booms the evidence of relationship between the tax treatment of residential property and real estate cycles in inconclusive (for more arguments about real estate markets see Crowe *et al.* 2011).

Nonetheless, the policymakers can still react via *avoiding fiscal / quasi fiscal incentives that may encourage certain type of lending*, specifically explicit subsidies, guarantees for housing loans, interest rate deductibility of mortgage loans. These measures reduce structural distortions that cause bias to economic incentives. Also, they may tame overheating pressures that undermine macroeconomic stability.

The cooperation of fiscal and monetary policy would achieve superior results, however it is rarely the case. Hilbers *et al.* (2005) argues that fiscal policy is appropriate to apply when ability to use monetary tools is limited or nonexistent. On the other hand, Galati & Moessner (2011) imply that given the governance issues and a lower frequency of fiscal policy decisions, in practice fiscal policy becomes more the Stackelberg leader. Consequently, monetary policy decisions that occur at high frequency take fiscal stance as given.

3.3 Prudential and Supervisory Measures

Prudential and supervisory measures are primarily concerned with strengthening the banking sector rather than dampening the credit boom. Nonetheless, Crowe *et al.* (2011) admits that when policy succeeded in slowing down a boom and avoiding systemic crisis in a credit crunch, it almost always involved some prudential measures.

Justification of the measures is yet subject to the nature of risk associated with the credit growth. Prudential and supervisory measures are suitable when eliminating inconsistencies or distortions in the market (e.g. excessive loan concentration or unhedged FX positions). Otherwise, prudential tools and supervision should be designed so that they support macroeconomic policies, i.e. they should be part of a comprehensive package of measures rather than a separated tool. Hilbers *et al.* (2005) emphasize that there are limits to what prudential policies can do in the absence of prudent fiscal polices, or if monetary fiscal regimes persistently create incentives that encourage credit growth. As a result prudential measures are typically employed along with monetary or direct instruments.

Successful implementation of prudential and supervisory measures stands upon a wide range of requirements. In detail, these are adequate enforcement capacity of regulatory authorities, cross-border supervisory cooperation (furthermore in case of foreign-owned banks, adequate scrutiny from supervisors in Western European home countries) and coordination between supervisors of bank and non-bank financial institutions. Unless a common dialog and cooperated measures are achieved, single attempts to cure the excessive credit growths may not only prove unsuccessful, but also create new loopholes in the system and introduce further obstacles. Put differently, it is impossible to design a stable and resilient domestic financial system independent of a global network.

3.3.1 Prudential toolkit

This section addresses both macroprudential and microprudential policy options. Sheng (2010) argues we must not make the intellectual mistake of separating macroprudential and microprudential supervision, because both are examining the whole and parts of the whole. Since individual activities have externalities, then what appears to be stable individual institutions does not necessarily add up to be a stable system. The fact that a system appears stable,

does not mean that individual components of the system are stable, especially if the externalities of parts cancel each other out (Sheng 2010).

Table 3.2 illustrates the basic stylized characterization of the different natures of two perspectives (for more detailed info see Borio *et al.* 2001, Borio 2003, Galati & Moessner 2011). The following part deals with the measures that were at least to some extend applied in CEE countries, specifically capital requirements, provisioning rules, eligibility criteria for loans (loan-to-value, loan-to-income rations), measures targeted on FX borrowing. Figure 3.2 further provides a detailed list the instruments in question.

Table 3.2: Macroprudential vs Microprudential perspectives

	Macroprudential	*Microprudential*
Proximate objective	Limit financial system-wide distress	Limit distress of individual institutions
Ultimate objective	Avoid macroeconomic costs linked to financial instability	Consumer (investor / depositor) protection
Characterization of risk	Endogenous (dependent on collective behavior)	Exogenous (independent of individual behavior)
Correlations and exposures across institutions	Important	Irrelevant
Calibration of prudential controls	In terms of system-wide risk; top-down	In terms of risks of individual institutions; bottom-up
Instruments	Countercyclical capital requirements	Quality / quantity of capital

Source: Borio (2003) and Galati & Moessner (2011)

Unlike monetary policy, prudential measures have narrower and more targeted goals which results in reduced costs. Their primary objective is to strengthen the banking system not to limit the credit boom. Therefore even if they fail to stop the boom, they may still help to cope with the crunch. On the other hand, few caveats are in order. First, as these instruments are more narrow, it is easier to circumvent them and encourage regulatory arbitrage and risk-shifting. Second, macroprudential framework is still in infancy, thus there is a call for more research to be done in this area. Third, authorities may face implementation impediments from the political standpoint. Crowe *et al.* (2011) notes that over time monetary policy decisions have come to be accepted as a necessary evil thanks to credibility and independence of the central banks. In contrast prudential measures might be considered as unnecessary intrusion

into the functioning markets and unlike macro policies such an implementation would clearly distinguish winners from losers. Specific measures also entail specific strong and weak points that are to be addressed as we discuss them in detail.

Higher capital requirements or higher risk weights help to reduce total lending capacity, create capital buffers and foster resilience against the losses during busts. Capital requirement can further be *differentiated* based on loan type, maturity, currency composition etc.

High risk weights require banks to hold more capital against a portfolio. Thus they can decrease ROAE of banks while creating larger capital buffers against losses. Provided the weights are risen unilaterally, specific country can be made less attractive vis-à-vis other regional markets.

In general the capital requirements in CEE region were well above the Basel II accords. Nonetheless, Bakker & Gulde (2010) argue that prudential measures need to be designed in accordance with risk profile. In context of CEE economies it means that rules may be more strict than in more mature economies. As we will discuss in the next chapter both capital requirement and risk weights built under Basel II were feared to be too low and consequently some countries decided to tighten the measures to correspond with their particular risk exposures.

Recently capital requirements have been extensively discussed especially in connection with its potential procyclical character (see Crowe *et al.* 2011,Galati & Moessner 2011, Shin *et al.* 2010). Literature standardly divides macroprudential measures based on their dimension into time-series and cross-sectional[3]. In particular, capital requirements could be able to address the time-series dimension of financial stability, i.e. help building capital buffers in good times and thus dampen inherited procyclicality of the system. Countercyclical change in risk weights by loan type can affect price of that particular lending. However, based on the CEE experience, Zumer *et al.* (2009) acknowledges that the recent crisis has underscored the importance of proactive policies in the upward phase of the credit cycle, notably policies minimizing procyclicality and building reserves for bad times.

Careful design of these measures is key to limit circumvention. Provided

[3] Time-series dimension captures the evolution of risk over time period. Cross-sectional dimension focuses on how risk is distributed at a point in time within the system. For detailed analysis see extensive literature overview on macroprudential policy by Galati & Moessner (2011).

settings get too complicated, enforcement could become cumbersome and the effectiveness easily undermined. The complexity of the set-up may be the issue especially in cyclical context (see Kashyap *et al.* 2008). Effectiveness is also limited when capital ratios are already high.

Tighter eligibility criteria for certain loans can be set through limits on loan-to-value ratio (LTV), loan-to-income ratio (LTI), debt service-to-income (DTI) etc. Eligibility criteria can work as quantity-based measures as they introduce limit on demand of credit. Stricter eligibility criteria can be very useful tool to reduce banking lending under condition that reporting requirements are adequate and supervision of both banks and non-banks is coordinated to limit risk of circumvention (Hilbers *et al.* 2005).

Loan-to-value ratio (LTV) measures willingness to pay, i.e. it reflects the size of downpayment. Often caps on LTV infer the character of default risk. Limits on LTV can prevent vulnerabilities on borrower side. Lower the leverage, the greater the drop in prices needed to put borrower into negative equity. From macro point of view it implies fewer defaults. Even in case of default, lender is able to obtain high recovery ratios (Crowe *et al.* 2011).

Loan-to-income ratio (LTI) and debt service-to-income (DTI) serve as affordability measures as they illustrates the ability to pay *vis-à-vis* the income[4]. Put differently, caps on the ratios anchor credit growth to the wage level. Therefore, caps on LTI or DTI reduce vulnerabilities to the financial sector as it becomes more resilient to drop in wages or temporary unemployment.

Since the measures are fairly clear, tighter eligibility criteria have immediate and transparent consequences. Nonetheless, a few concerns are in place. First, the eligibility criteria greatly depend on approaches to the valuation of collateral. Second, the role of regulatory measures is of great importance. Third, the calibration of caps on LTV, DTI and LTI is still at infancy. This is particularly the case in countercyclical measures. Borio *et al.* (2001) provides elaborated discussion of LTV and experiences of the developed countries. Nonetheless, when applicable tighter eligibility criteria should go hand in hand with *tighter rules on valuation criteria*.

[4]Although there is no common definitions of these ratios, they usually exclude information such as borrower expenses or tax liabilities. In particular, they are usually defined as follows:

$$DTI = \frac{\text{All debt-servicing payments}}{\text{Gross income}}; LTI = \frac{\text{Monthly payment of the loan}}{\text{Monthly income}}$$

Liquid asset requirements (LAR) can work for both monetary and prudential purposes. From monetary perspective it is an obligation of commercial banks to maintain a predetermined percentage of total deposits and certain other liabilities in form of liquid assets (Guide *et al.* 1997). Higher LARs force banks to demand more liquid assets and vice-versa. From prudential perspective, tighter LARs provide "sand in the wheels" against rapid lending by forcing banks to hold funds in liquid assets (Hilbers *et al.* 2005). As a consequence, Hilbers *et al.* (2005) emphasizes that LARs can help to control lending capacity via suitable selection of eligible securities, eligible maturities, and averaging methods.

LARs are favored thanks to their simplicity and ability to be monitored relatively easily. On the other hand, LARs tend to be often replace by a more market-based instruments. Nonetheless, LARs are sometimes imposed along with other instruments. For instance, FX currency liquidity requirements can effectively be accompanied with higher LAR on short-term liabilities.

FX-targeted measures were fairly popular among CEE economies given the elevated level of FX-denominated loans in a few countries. Foreign currency borrowing and associated risks has been largely discussed in academic literature (see Rosenberg & Tirpak 2008, Bakker & Gulde 2010). As a matter of fact two main scenarios applied in CEE region were: central authority introduced FX-targeted measures in order to either limit specific issues such as capital inflows or rapid credit boom in foreign currency or central authority introduced FX-targeted measures along with other domestically-oriented policies and also discussed exchange rate measures.

Hence there is a wide range of tools to limit the FX-denominated lending on both demand and supply side, in particular:

(a) Tightening of net open position limits for banks
(b) Imposing special capital requirements or risk weights on the currency composition
(c) Imposing marginal reserve requirements on foreign liabilities (see Box 3.1)
(d) Targeting unhedged borrowers, tightening eligibility requirements for FX loans, limiting FX loans to borrowers with foreign income or adequate hedging
(e) More intensive surveillance and monitoring of banks with large share of FX loans in their portfolio

3.3.2 Supervision and Monitoring

High speed of credit growth can introduce pressure on otherwise strong and resilient financial sector. As a consequence policymakers need to resort to tighter supervisory and monitoring measures. The objectives are mainly to strengthen market discipline on banks, improve transparency of the system, limit room for aggressive lending practices or counter liquidity, credit, interest rate, foreign exchange and systemic risk associated with credit booms.

Hilbers *et al.* (2005) emphasize market-based instruments such as use of periodic stress testing, improved reporting and disclosure rules, periodic surveys of FX exposures etc. Furthermore, the essential part of successful supervision and monitoring is to improve coordination of bank and non-bank supervision as well as the collaboration with home supervisors of foreign-owned banks. The latter measures are particularly important in order to prevent regulatory arbitrage and further circumvention issues.

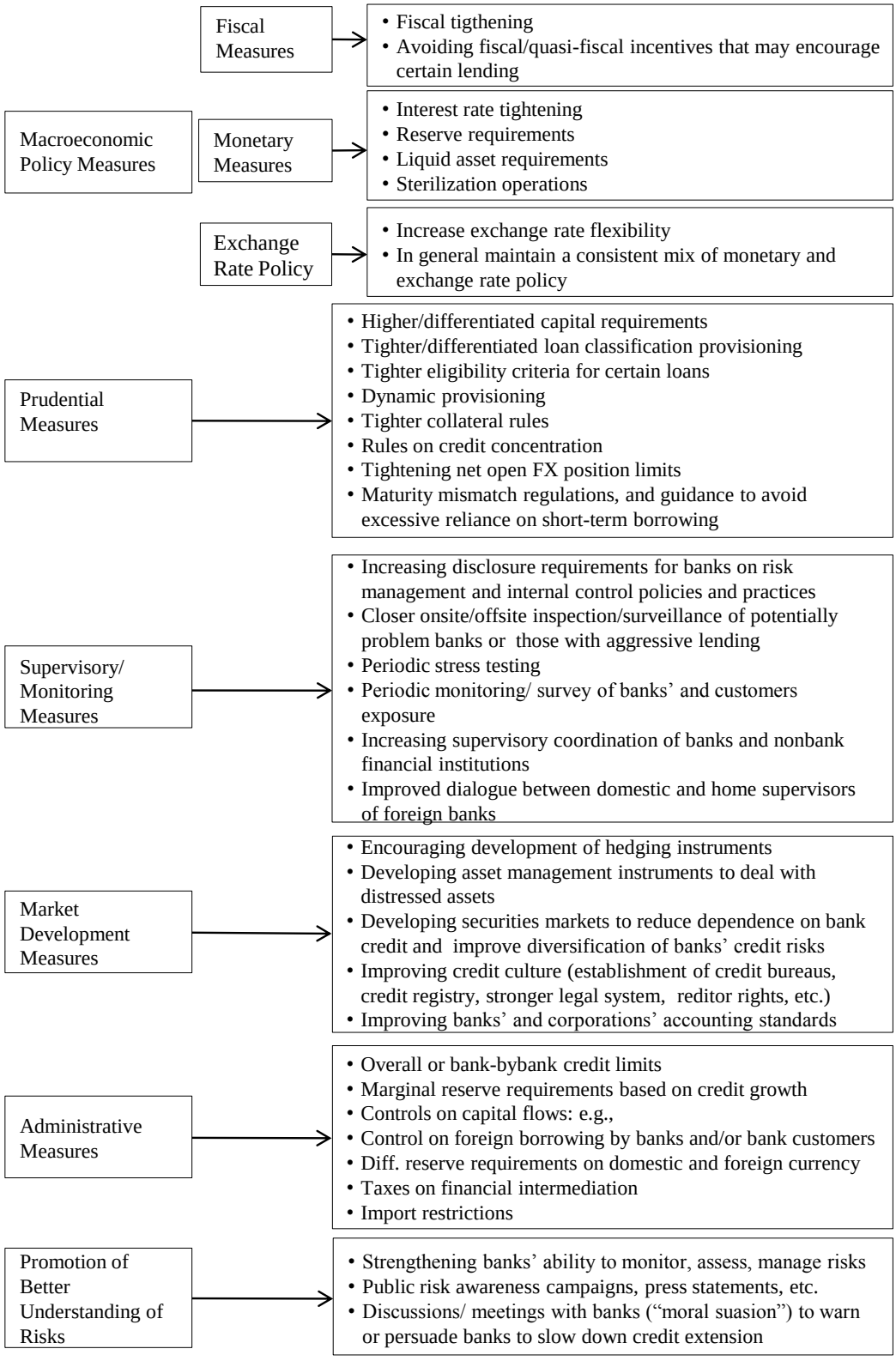
3.4 Other Measures

To get a full picture of possible policy options, we also need to approach two extremes: the measures of the first and the last resort. The first is promotion of better understanding of risks, the latter are administrative measures.

Promotion of better understanding of risks is a keystone in improving credit culture in the economy. For illustration those are disclosure of information, consultative meetings with banks, establishing credit bureaus and registries. Although, such tools are rather soft techniques, they play crucial role in strengthening market discipline and capacity to cope with credit booms.

On the side of the spectrum are administrative measures. Administrative (direct) measures are explicitly aimed to limit the source of funding, for instance controls on capital inflows, reserve requirements on bank borrowing from abroad, differentiated reserve requirements on domestic and foreign currency. Direct tools are strong inhibitors of credit growth. However, on the other hand, they often entail huge costs, distortions and their effect is mostly only temporary. Administrative measures are advised to apply only as a last resort policy, however, as will be analyzed further, these tools did occur in CEE region over the researched period.

Figure 3.2: Menu of Policy Options to Rapid Credit Growth



Source: Hilbers *et al.* (2005)

Chapter 4

Survey results: Policy measures

The chapter summarizes policy responses in the period of the most pronounced credit boom (2003-08). We attempt to answer a set of questions: What instruments were used the most to alleviate credit boom in CEE region? How much did the measures differ regionally? Can we observe any patterns or trends over time period?

As has been discussed in Chapter 2, credit developments significantly varied across the region. Policy measures also offer wide scale of intensities. Chapter 3 listed the menu of tools policymakers have in hand to counter the credit boom, their strengths, weaknesses and potential implementation issues. However, the tools can be applied for a different purposes from price stability, capital inflows to upgrading local supervision in line with the EU standards. It is particularly challenging to identify a toolkit that can be considered to influence the credit growth. Hilbers *et al.* (2005), that hugely contributed to the discussion, approached the measures with *potential* impact on credit growth.

Our data were collected via direct survey among eleven central banks. In the survey, central banks were kindly asked to provide us with the information whether or not they implemented any of the instruments in period 2003-2008 to control the credit growth *per se*. Based on direct involvement of central banks, we assume good accuracy of the policy responses. Nonetheless, we acknowledge the interconnection of the goals.

The chapter is organized as follows: first we list the overall results of the survey, next the developments are discussed on regional basis by splitting the CEE into three sub-regions. At last, we look more closely at the most popular measures used.

4.1 Summary of the results

The core data were collected via direct survey across the central banks in the CEE region. Central authorities were asked to provide information regarding the measures used over the period 2003-2008 to control the credit growth. The survey consisted of three main parts: *a*) monetary policy measures, *b*) prudential and supervisory measures, and *c*) administrative and other administrative measures. Hilbers *et al.* (2005) conducted an analogous study covering responses to the credit developments until mid-2005. The study was used as a guidance to clearly select relevant areas of the issues.

The survey was conducted in form of a simple questionnaire where central banks were to identify whether or not they undertook any of the listed instruments in period 2003-2008. If affirmative, they were to specify the date (month and year) when such steps were taken. Importantly, we managed to receive responses from all eleven central banks (return ratio = 100%)[1].

Table 4.1 illustrated the overall list of measures used within the region. As can be inferred the CEE experience is very rich, every measure asked was implemented at least in one of the countries. Yet, the country experiences varied significantly. This conclusion is in line with the estimation results of credit growth excessiveness that is conducted in Chapter 2. Most of the countries that were identified to exhibit the rapid credit booms resorted to more active policy involvement. On the other hand, the heterogeneity of the responses across the CEE region provide us with a unique possibility to compare the countries that made more effort to act against the adverse developments with the other in the region via difference-in differences estimations.

Hypothesis 4.1. Exchange rate regime mattered both in scale and scope of responses.

When looking at the table 4.1, we can clearly cannot reject the hypothesis that exchange rate regime played a significant role in scale and scope of responses. The fears about excessiveness of the credit growth came predominantly from fixed exchange rate regimes, to be more specific from countries operating under formal currency boards (Bulgaria, Estonia or Lithuania), quasi-currency boards (Latvia, Croatia[2]). Additionally, having their hands tied in

[1]Bank of Slovenia provided us only with the Yes/No answers to the tools without stating the dates of implementation. Given the fact that Slovenia does not fall into the category of countries that used such policy measures extensively, the response is of valuable significance nonetheless.

[2]The *de jure* and *de facto* regimes in Croatia differ markedly. National Bank of Croatia

case of interest rates or exchange rate tools, the countries introduces a rich record of various prudential and supervisory activities. Most of the measures were moreover specifically targeted to the key issues of the credit developments, namely FX-denominated private borrowing often in form of housing loans.

The overall assessment is however mixed. Among the most important reasons for underperformance is the insufficient scrutiny of foreign parent banks. In particular the main problem was rooted in lack of enforcement capacity and weak cross-border supervisory cooperation. This argument was permanently stressed in the literature prior (Hilbers *et al.* 2005) or after the financial meltdown (Bakker & Gulde 2010). The lack of supervisory coordination contributed to creation of loopholes such as shift from FX-lending of local subsidiaries directly to foreign mothers, or shift to less regulated and supervised non-bank financial institutions (notably leasing companies) that conducted quasi-bank activities and fell outside the regulatory horizon. On the top of that, selected countries experienced also faced persistent issues with domestic yet systematically important banks (Hungarian OTP Bank or Latvian Parex).

Hypothesis 4.2. Policy measures were mostly reactive rather then proactive or counter-cyclical.

There has been a substantial criticism regarding the type and timing of policy responses. Taking the fiscal stance, Bakker & Gulde (2010) emphasized that with the benefit of hindsight, public expenditure growth should have been more restrained during the boom years. If the surge in revenues had been used to build up increasing fiscal surpluses, fiscal policy would not have further fueled overheating (Bakker & Gulde 2010). Based on the survey results, only Latvia undertook changes in taxation to discourage lending practices (the change in taxation was aimed at real estate transaction, see Chapter 5). Notwithstanding Martin *et al.* (2009) argued even in the specific case of Latvia, the post-financial turmoil implementation of the fiscal measures stimulating the economy proved to be a very complicated task since the government has not accumulated any reserves in good times.

Evaluation of prudential and monetary stance is more questionable. First of all, policymakers devoted much effort to design prudential and supervisory measures get in line with the Western European best practices and Basel II

implements the exchange rate regime of managed floating *de jure*. However in the light of highly euroized financial system Croatia operates under *de facto* quasi-currency board allowing for exchange rate volatility to discourage one-way gambles and speculation and at the same time encourage FX hedging.

requirements. Secondly, the levels of capital buffers were even higher than the latter listed requirements and practices. The rationale behind a more prudent stance of particular economies once again stems from the nature of the region (its relative immaturity, riskiness and and turbulent credit developments).

Moreover, leaning against the wind during good times had at least partially positive effect (see evaluation of Recommendation S in Poland in Chapter 5, or detailed assessment of selected Croatian measures performed by Galac 2010).

Since the objective of this thesis is to evaluate the effect on the credit developments prior to the crisis rather than their counter-cyclical character of the instruments, there are two main points to consider. First, the reactiveness character of central authorities stemmed from the wide range of circumvention practices used by the banks. A few country experiences report shift of activities to less well-regulated parts of the financial system as a response to more prudent measures. Consequently, some countries reacted by further measures to counter the newly emerged adverse issues (broadening of the base for reserve requirements or extending the supervision).

Second, even when the countries attempted to pro-actively introduce changes to the potentially dangerous issues, the circumvention was not rare. As a result, when evaluating the successes of most measures, successes turn out to be short-lived or we need wider datasets (on not only bank credit but also account for non-bank data) to correctly asses the issue.

Figure 4.1: Number of policy measures over time in CEE (quarterly data)

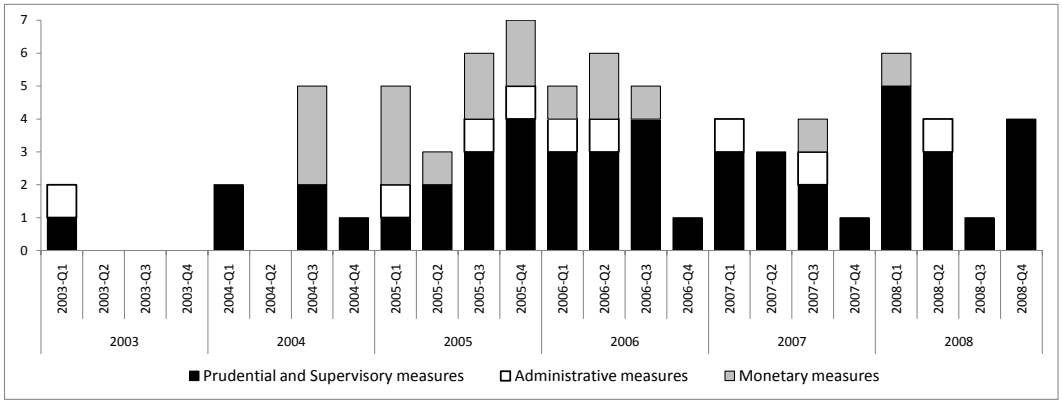


Figure 4.1 illustrates the time evolution of the measures used in entire CEE region. The reactiveness of the measures can also by supported by the frequency. In particular, unless facing serious issue most policy responses were

"late risers". The peak of policy activities was in second half of 2005 and first half of 2006. With respect to specific type of responses, we can observe that monetary measures were used among the first ones. Over time they mostly reached their limits and authorities turned into more specific prudential and supervisory tools.

Prudential and supervisory toolkit is particularly rich and offer a wide range of relevant country lessons. As one can infer from figure 4.1 the measures were popular until the end of the researched period, i.e. early stage of global financial crisis. This is also because the measures are not directly powerful for slowing down the credit boom but they are designed to foster the resiliency of the banking sector. From this perspective the best scenario would be to achieve a less pronounced credit growth as a welcome side-effect of more stable financial system.

Few economies facing the most serious external imbalances also undertook more controversial direct measures (credit ceilings or capital controls). The overall amount of such measures does not strictly correspond to the data showed in Figure 4.1 as all the modifications and amendments to the existing measures taken in different periods are displayed.

For observed period Croatia witnessed two credit ceiling periods (from January 2003 until the end of the year, from November 2007 until 2009[3]). Next experiences occurred in Bulgaria (since March 2005 with further adjustments taken over 2005 and 2006) and Romania (September 2005). In mid-2008 Lithuania also resorted to capital controls.

The timing and the type of responses will be further discussed by splitting the region the three subgroups as in Chapter 2: Central (CEE-5), Baltic (BE-3) and Southeastern (SE-3) European economies.

[3]The credit control was only eliminated in November 2009. The lifting of the tax was delayed due to fears that removing the tax would give banks room to depreciate the exchange rate

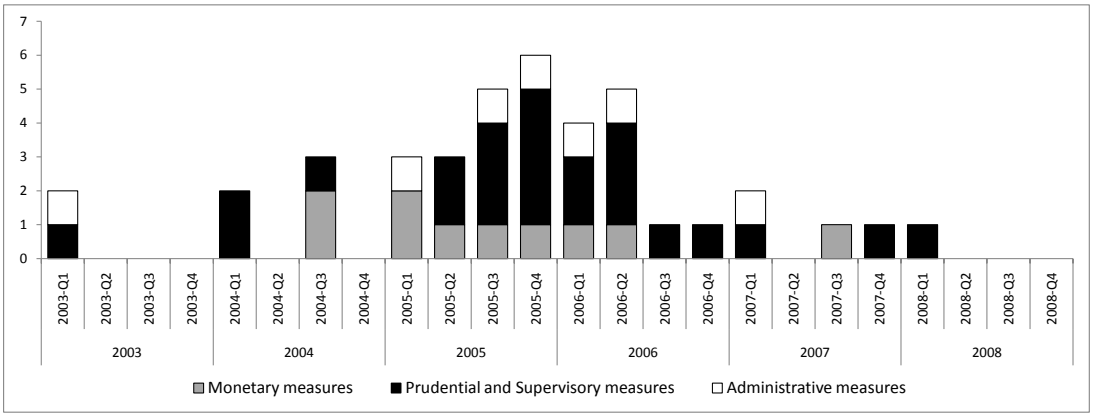
Table 4.1: Survey results - policy responses used in CEE (2003-2008)

Measures	**CZ**	**SK**	**LT**	**LV**	**EE**	**HU**	**PL**	**RU**	**BG**	**HR**	**SI**
Monetary measures											
Interest rate response				x			x	x			
Reserve requirements				x	x			x	x	x	
- Changes in the required level				x	x			x	x	x	
- Differentiated by currency								x			
- Differentiated by type of deposit				x							
- Broaden the reserve base				x				x			
Prudential and Supervisory measures											
Capital requirements (higher / differentiated) or higher risk weights			x	x	x	x	x	x	x	x	
Liquid asset requirements		x					x			x	
Tighter asset classification rules								x	x		
Tighter provisioning rules				x				x	x		
Tighter eligibility criteria for certain loans				x		x		x			
- Limit on LTV				x				x			
- Limit on LTI / payment to income								x			
Tighter rules on valuation criteria											x
Measures targeted on FX borrowing			x	x			x	x		x	
- Targeting unhedged borrowers				x			x	x		x	
- Tighter net open position limits			x	x							
Soft measures - new non-binding guidelines for banks		x	x	x	x	x	x		x	x	x
Tighter supervision				x		x		x	x		
Administrative and other measures											
Capital controls			x								
Credit ceilings								x	x	x	
Taxes on real estate transactions				x							

4.2 Regional view

4.2.1 Southeastern economies

Figure 4.2: Number of policy measures over time in SE-3 (quarterly data)



Group of Southeastern European economies (SE-3) consists of Bulgaria, Romania and Croatia. All listed countries were particularly active over the entire period by means of implementing wide range of measures to curb the credit growth. Besides the conventional practices, SE-3 has rich record of non-conventional measures such as marginal reserve requirements, special reserve requirement or credit ceilings. This was also because the listed countries faced substantial capital inflows that strongly influenced the local developments. On the other hand, by the end of the 2008 these economies were among the first ones that implemented countermeasures (e.g. relaxation of reserve requirements at the end of 2008 in Bulgaria).

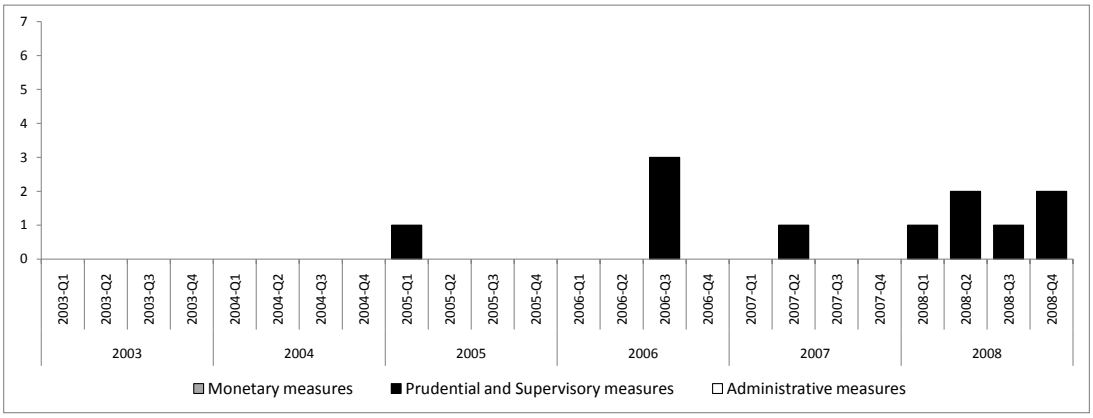
The activeness of policymakers rocketed in 2005 and 2006 when measures taken within SE-3 amounted to 90% of all the measures in CEE region. This is also why SE-3 can provide useful lessons learned for other not strictly CEE countries. Interestingly, all three economies have personal experience with the most evasive instrument, i.e. credit ceilings (see Chapter 5) to curb the predatory FX lending practices and capital inflows. Anyway, the overall effect of administrative measure was mostly short-term.

When evaluating the effectiveness of quantitative measures in the SE-3, the policymakers agree on the long-term effectiveness eroded over time due to many circumvention practices. Side-effects, evasion techniques and synergies between domestic subsidiaries and foreign parent banks were often the case. Further-

more, Romanian authorities add that some credit institutions resorted to the reconfiguration of key features of their loan offer, trying to dilute the constraints exercised by the administrative and prudential measures on indebtedness level of households. On the top of that reduction of the debt service burden at origination was often altered by increasing the maturity of loans or by using different promotional offers with reduced rates in the first years of the facility.

4.2.2 Central European economies

Figure 4.3: Number of policy measures over time in CEE-5 (quarterly data)



This set is the largest since it includes almost half of the CEE countries (Czech Republic, Slovakia, Slovenia, Hungary and Poland). Nonetheless it is also a set of five countries that showed more neglect towards listed policy measures. The small rate of active participation is however reasonable provided the countries did not face large external vulnerabilities connected with the credit developments.

Based on the analysis of credit excessiveness in Chapter 2, all the countries but Hungary experienced the least pronounced credit boom especially with comparison to the rest of the region. As a consequence, the amount of policy responses can be justifiably smaller.

Furthermore, all the listed tools were of prudential and supervisory nature and were either aimed at improvement of the resiliency of the banking sector (especially via capital requirements or non-binding guidelines for banks) or control of the FX borrowing that could be particularly dangerous if domestic agents undervalue the FX risks of floating exchange rate regimes.

The most important intervention is the Recommendation S introduced by Polish authorities in the third quarter of 2006 which is analyzed in detail in chapter 5. Yet it is crucial to stress the was originally designed to the specific problem of high portion of unhedged FX borrowing.

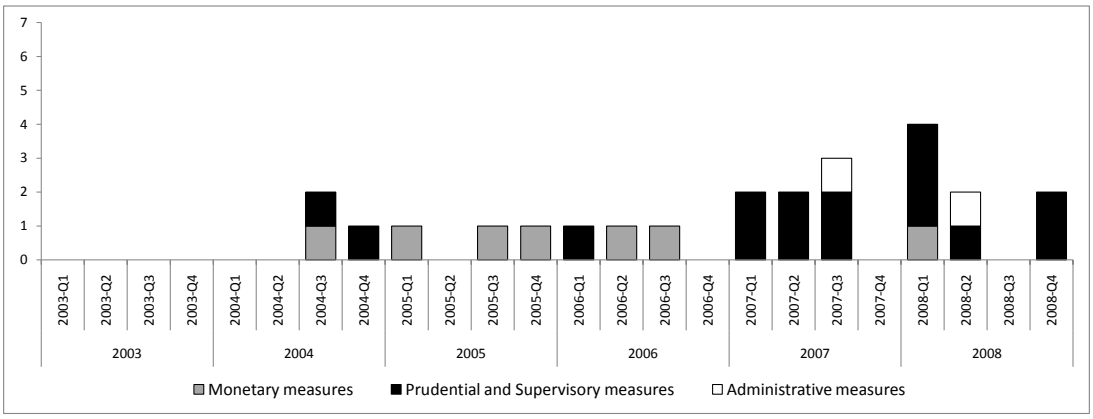
The fact that the economies did not attribute much resources to introduce measures that would be directly aimed to control for the credit development allows us to use the countries as control samples in event studies exercises. Namely, we will work with Czech Republic (entire period) and Slovakia (2003-2007). At the verge of financial turmoil in October 2008, Slovak authorities implemented soft measures connected with the introduction of the new liquidity asset indicator and close daily monitoring of the liquidity indicator. Given the timing the measures were however mostly linked to a closer management of the liquidity risk rather than credit boom issues.

The responses in Hungary were also scheduled only to the later phase (since February 2008). The objective of the measures was more targeted to limit growth of FX lending. Central authorities introduces complex measures to account for FX risk in capital requirements and also to improve the risk consciousness of both consumers and financial institutions. The phenomenon of FX lending became more relevant issue since 2003 when conditions for government-subsidized mortgages tightened and borrowers opted for FX lending schemes instead. Provided the measures had been employed earlier, it would have been possible to analyze their effectiveness. However, given the fact that all of them occurred in 2008, they coincide with the financial crisis and thus the assessment of the slowdown cannot be attributed to the measures themselves. Another interesting factor to consider in this region is that even though the economies operate under the floating exchange rate regimes, the FX risk did not contribute as significantly to the measure responses as in case of economies with currency pegs.

4.2.3 Baltic economies

In BE-3 we can observe continual shift from monetary instruments to prudential and supervisory tools. In the late 2007 and early 2008 we can even encounter two administrative procedures. In the third quarter it is a case of change in taxation on real estate transactions in as a part of comprehensive Anti-inflationary plan in Latvia and in mid-2008 it is a case of Lithuanian capital controls.

Figure 4.4: Number of policy measures over time in BE-3 (quarterly data)



Until 2006, the measures were almost exclusively oriented on either reserve requirements or capital requirements. The only reported exception is strengthening supervision in Latvia in 2004. In the second half of the period (since 2007), policymakers devoted more to specific instruments to curb the real estate growth and real estate related borrowing (Table 4.2). Development of the real estate sector is identified to be one of the main problems in this regional context (including overestimation of collateral, predatory lending practices of foreign banks and overoptimism about the future).

Table 4.2: Survey results - specific policy responses used in BE-3 in the second half of the period

	Measures	Frequency
2007	Change in taxes on real estate transactions	1
	Limit on LTV	1
	Soft measures - new non-binding guidelines for banks	3
	FX measures - tighter net open position limits	2
2008	Capital controls	1
	Capital requirements (higher/differentiated) or higher risk weights	2
	Changes in the required level	1
	Limit on LTV	1
	Soft measures - new non-binding guidelines for banks	1
	Tighter provisioning rules	1
	Tighter supervision	1
Total		25

Even though the structure of the economies is fairly similar, the scale and responses very much differ form each other. On one hand we can see Latvia as the most active player (see also specific country experience of Anti-inflationary plan in Chapter 5). On the other hand, Estonia implemented only limited

amount measures and what is more relatively market-friendly. Hence we will also use Estonian case as a control country to discuss the measures taken elsewhere in the BE-3.

4.3 The most popular measures

Table 4.3: Frequency of the measures used

	Total frequency	*Amount of countries*
Interest rate response	N/A *	3
Reserve requirements	12 **	5
Capital requirements (higher/differentiated) or higher risk weights	12	8
Liquid asset requirements (introduction/tightening)	3	3
Tighter asset classification rules	3	2
Tighter provisioning rules	3	3
Tighter eligibility criteria for certain loans (via LTV, LTI etc.)	5	3
Tighter rules on valuation criteria	1	1
Measures targeted on FX borrowing	5	5
Soft measures - new non-binding guidelines for banks	13	9
Tighter supervision	7	4
Capital controls	1	1
Credit ceilings	4 ***	3
Change in taxes on real estate transactions	1	1

* Even though the interest rates measures were common, the frequency of implementation for credit growth slowdown purposes is uncertain (see Box 4.5).
** Twelve regular RR plus five additional MRR and one SRR in case of Croatia.
*** Four independent credit ceilings plus three additional extensions or adjustments of MRR in case of Bulgaria.

4.3.1 Soft measures

Undoubtedly the survey reveals soft measures to be of the highest popularity. Nine out of eleven countries issued non-binding guidelines for the banks at least once over the years 2003-08. Moreover, many countries continued with moral suasion and soft measures targeted at domestic consumers.

From the time aspect, all the guidelines were introduces in the later part of the period (2006-2008). Majority of them was concerned with proposing more prudent risk assessment and lending practices with special attention to FX lending. Their main objective was to stimulate banks to adopt new polices and procedures to identify, monitor and control especially the credit and FX risks of the borrowers.

In some cases the measures were taken also in form of more binding guidelines (strengthening of the supervision). For illustration, a recommendation issued by Bulgarian authorities urged banks not to extend credit to households subject to threshold value of disposable income in 2006 when non-adherence to the recommendation could result in additional supervisory measures.

Soft measures were also effectively combined with other instruments such as in Polish Recommendation S. Alternatively, the non-binding guidelines were also often succeeded by tighter supervisory rules. However, the evaluation of the measures is not very positive. Estonia, that engaged in moral suasion for the entire period, admits the credit expansion continues nonetheless. Hungarian attempted to improve customer consciousness about the underlying risks neither managed to achieve any palpable results. On the top that, since the measures mostly occurred in the last phase, majority of their effects are hard to distinguish from the impact of the crisis.

4.3.2 Capital requirements and risk weights

Modification of capital requirements is considered to be the second most popular policy option. However in this respect we need to be very careful since the researched period covers the time span within which the countries were to adopt the Basel II requirements. This fact can be potentially reflected in the "popularity of the measure" as well. Since this thesis does not deal with the issue of the impact of Basel II, we will concentrate of other modifications of the capital requirements namely those taken predominantly to curb the credit growth. Still, it is viable to stress that that most of the economies still kept the capital adequacy ratio well above 8%.

Furthermore, the survey results also clearly state the vast majority was more concerned with adjustment of the risk weights. Higher risk weights were widely applied to two cases: real-estate related loans and FX loans.

The first measure was applied in countries facing real estate booms along with credit booms (e.g. Estonia, Latvia, Lithuania, Bulgaria). Weights for real-estate related loans were sometime raised to the amount of 100%. The measures were mostly targeted at mortgages of households or/and commercial property. In Bulgaria they went hand in hand with tighter eligibility criteria (limits on LTV was lowered from 70% to 50%.

The latter measure was also popular in case of real estate booms since the largest portion of private FX loans were taken in form of mortgages. For exam-

ple, in 2008 Hungarian capital requirements were increased for loans denominated in Japanese Yen under Pillar 2 of Basel II. On the other hand, Croatia required extra capital buffers to be created for loans to unhedged borrowers. Prior to Basel II Croatia required higher risk weights for loans to unfledged borrowers (originally set at 25%, later increased to 50%). Later, in 2006 it introduces guidelines to banks on management of foreign currency induces credit risk (FCICR).

Figure 4.5: Box - Interest rate deadlock

Even though interest rate increases were common during the researched period, none of the central banks applied them with respect to the credit boom. For illustration based on the survey results, National Bank of Poland changed key policy rates a number of times in order to balance the risk of inflation. Although credit developments contributed to the the inflation outlook, it cannot be concluded that interest rate changes were specifically targeted to fight the credit growth.
Furthermore, many central banks identifies a number of undesirable side effects of interest rates tightening:

(a) *Transition problem* Many economies witnessed increasing competition but still relatively ample profit margins for financial institutions. Banks were willing to absorb higher funding costs (associated often with conventional monetary policy measures) without affecting the lending costs.

(b) *Exchange rate framework* Countries experiencing the most pronounced credit boom were constraint by currency peg to euro (Baltic states, Bulgaria).

(c) *Foreign ownership of banks* allowed banks to obtain financing from parent banks. Lending standards were in line with home conditions (relevant mainly for Baltic countries).

(d) *FX borrowing*, as one of the most risky drivers of credit boom, would not only remain unaffected but in case of significant interest rate differentials would be even spurred by the domestic rate tightening.

(e) *Already high capital inflows* would under rising interest rates increase even further while credit growth response was uncertain (fear in Croatia given the past experience of Serbia).

(f) *Low initial level of household debt* was often the case. Experience of Latvia in 2003-05 showed that even thought interest rates were implemented the financial deepening persisted.

4.3.3 Reserve requirements

Four out of eleven central banks resorted to tightening of reserve requirements to dampen the effect of credit boom: Romania (2004-2005), Croatia (2004-06), Estonia (2006) and Latvia (2004-06). Interestingly, all the changes occurred in the first half of the researched period, suggesting that RR could have been one of the first measures tried. As the credit development data imply, the boom did neither not stop nor slow down in 2006 hence the overall effectiveness is questionable. Thus the questions emerge: Why was the timing so consistent among the countries? Were the measures consistent across the region as well? What were the channels of circumvention?

The time consistency issue may lie in relative simplicity of implementation. Moreover RR fall into the category of conventional monetary tools. This very argument also justifies the sudden stop of RR tightening: levels in CEE region were well above average level in euro area and their efficiency was limited by shifting more upwards. For illustration, standard RR on liabilities denominated in domestic currency were set as high as 18% in Romania and Croatia or 15% in Estonia. Nonetheless, the overall quantitative constraint was not the strongest nor the most popular measure.

The rationale behind is that most dangerous was not the pace of credit growth *per se* but the underlying currency and maturity mismatches. As a result, central authorities decided to act by broadening the reserve base (Latvia in 2005 and 2006, Romania twice in 2005), differentiation by type of deposit (Latvia in 2005 and 2006) and differentiation by the currency (Romania 2004 and 2006).

Croatian experience is particularly interesting as the authority actually lowered the minimum required reserve ratio multiple times over the researched period (counter-measures) while introducing new measures *marginal reserve requirements* (MRR) and *special reserve requirements* (SRR). Although both MRR and RR differentiated by the currency have the same goal (to control the excessive FX-denominated borrowing), the contrast is in the marginal character of MRR (call for additional requirements only to the *increment* of FX liabilities). Nevertheless, the further modification were again feasible - broadening of the base, change of the reference period etc. On the other hand, SRR were introduced only once (at the late stage of MRR application) and they called for special requirements of 55% on liabilities arising from issued securities. Yet again, they were also differentiated by the currency.

Table 4.4: Reserve requirements

Country	Type	Measure	Date	Details
Croatia	RR	Changes in the required level	2004-10	Decrease to 18%
Croatia	RR	Changes in the required level	2005-12	Decrease from 18% to 17%
Croatia	RR	Changes in the required level	2008-11	Decrease from 17% to 14%
Croatia	MRR	New measure	2004-07	MRR at 24 %, reference period: 2004-07
Croatia	MRR	Changes in the required level	2005-02	From 24% to 30%
Croatia	MRR	Changes in the required level	2005-05	From 30% to 40%
Croatia	MRR	Reference period	2005-11	Upgraded reference period: 2005-11
Croatia	MRR	Broaden the reserve base	2006-01	MRR at 55%, extended base (to include guarantees and other investments kept off balance sheet)
Croatia	SRR	New measure	2006-02	SRR at 55% on introduced on liabilities arising from issued securities, reference period: 2006. Calculated separately for FX and domestic currency
Croatia	MRR	Broaden the reserve base	2006-06	Extended base (to include increases in funds received from nonresidents and legal persons in a special relationship with a bank which are used to finance domestic entities in the form of syndicated loans or in the name and for the account of the mandated operations)
Estonia	RR	Changes in the required level	2006-09	Decrease from 13% to 15%
Latvia	RR	Changes in the required level	2004-07	From 3% to 4%
Latvia	RR	Broaden the reserve base	2005-01	Liabilities to foreign banks and foreign central banks included
Latvia	RR	Changes in the required level	2005-08	From 4% to 6%
Latvia	RR	Changes in the required level	2005-12	From 6% to 8%
Latvia	RR	Broaden the reserve base	2006-05	Liabilities with maturity more than 2 years included
Latvia	RR	Changes in the required level	2008-02	If maturity more than 2 years RR from 8% to 7%, otherwise RR remained 8%.
Romania	RR	Differentiated by currency	2005-02	FX-denominated from 25% to 30%, RON-denominated remained at 18%
Romania	RR	Broaden the reserve base	2005-02	RR on FX broadened to included all liabilities irrespective of maturity
Romania	RR	Broaden the reserve base	2005-07	
Romania	RR	Differentiated by currency	2006-03	FX-denominated from 30% to 40%

The outcome of various RR measures did not fulfill the expectations. On the plus side, Hilbers *et al.* (2005) acknowledged that in case of Estonia the term structure of FX borrowings improved. The overall effectiveness of RR was short-lived as domestic players quickly adapted to new constraints. Domestic subsidiaries externalized part of FX loan portfolios to balance sheets of foreign parent banks or the subsidiaries operated as their agent (in case of corporate clients).

Furthermore, activities were often shifted to the less regulated sector of leasing companies. Banks also started to engage in asset swaps, collateralization,

accelerated NPL write-offs (Hilbers *et al.* 2005). All of this, adversely affected data transparency. As central authorities reacted to these efforts by broadening the reserve base, local agents found new ways of circumventions.

4.3.4 Measures targeted on FX borrowing

As has been already discussed many of the listed tools were aimed at inhibiting FX borrowing (special weights on capital requirements, targeted non-binding guidelines or reserve requirement differentiated by the currency). Additionally, the survey further requested central banks to provide an information whether there introduced more measured targeted on FX borrowing mainly by targeting unhedged borrowers or tighter net open positions.

Altogether five countries adopted one of the listed measures. The experience is fairly rich as it covers all the sub-regions: Poland (CEE-5), Latvia and Lithuania (BE-3) and Croatia and Romania (SE-3).

The overall evaluation is again mixed. The measures mostly managed to cut the FX lending practices of the subsidiary banks. However, in some cases banks only shifted their activities directly to the parent banks. On the other hand, the case of Poland illustrates a success since the measures helped to shift foreign currency lending to domestic currency lending that is easier to manage in terms of conventional policy tools especially and poses less risks especially in floating exchange rate regime framework. Two different experiences Poland and Latvia are discussed in detail in Chapter 5.

Chapter 5

Selected country experiences

5.1 Methodology of Difference-in-differences

Difference-in-differences (DID) allows to "experiment" on real (non-experimental) data. DID tries to find a naturally occurring comparison group that could mimic the properties of the control group in the properly designed experimental context (Blundell & Costa Dias 2000). In our case the series of non-experimental data is the private credit growth in countries of CEE region. Since not all the countries intervened against credit growth the dataset of eleven countries can be divided into two groups: control and treated countries.

Let us start by introducing the basic terminology. We define the *event* as a month and a year when the central authority applied a measure to control the credit growth. *Event window* is either twelve or six months depending on the frequency of measures used by the central banks.

Time series are credit to private sector obtained from IFS IMF database (recalculated into annual growth rates). When needed, we further work with specific data on only housing loans or credit differentiated subject to currency (FX-denominated loans, domestic currency denominated loans).

Success of a measure is the most challenging issue. Given a pronounced credit boom, it is unlikely that *direction criterion* (change from credit increase to credit decrease) would be of much help. Hence the success is judged by the *smoothing criterion*, i.e. measure led to small credit growth compared to a preceding period:

$$\Delta Y_{i,t=0} > \Delta Y_{i,t=1} \tag{5.1}$$

Furthermore, the success is justified on a country comparison based on

difference-in-differences estimator. The basic DID framework can be described as follows:

$$Y_{i,t} = \delta_t + \alpha D_{i,t} + \eta_i + \nu_{i,t} \tag{5.2}$$

where $Y_{i,t}$ is a credit growth of country i at time t. We split the researched period t into two parts: pre-treatment period ($t = 0$) and post-treatment period ($t = 1$). In the pre-treatment period none of the countries intervened against the credit growth and we may assume they were following the parallel paths. Then, a measures is put into practice. We denote control country as $D_{i,1} = 0$ as a country that did not apply any explicit measures to alleviate the credit growth. Treated country is denoted as $D_{i,1} = 1$. To summarize:

$$D_{i,t} = \begin{cases} 1 & \text{treated group in post-treatment period (t=1)} \\ 0 & \text{otherwise.} \end{cases}$$

Furthermore in equation 5.2 α stands for the impact of treatment. δ_t represents time specific component (e.g. common macro effect shared by all countries), η_i country-specific component constant over time and $\nu_{i,t}$ is temporary country-specific component that has zero mean at each period.

Given our analysis, not all the variables are observable. As a consequence, in line with Blundell & Costa Dias (2000) we define $U_{i,t}$ as unobservable component:

$$U_{i,t} = \delta_t + \eta_i + \nu_{i,t} \tag{5.3}$$

The crucial assumption is that unobservables for both treated and controls are same in first differences:

$$E[U_{i,1} - U_{i,0} \mid D_{i,1} = 1] = E[U_{i,1} - U_{i,0} \mid D_{i,1} = 0] = E[U_{i,1} - U_{i,0}] \tag{5.4}$$

The DID estimator can be then denoted as:

$$\begin{aligned} \hat{\alpha} = \{E[Y_{i,1} \mid D_{i,1} = 1] - E[Y_{i,1} \mid D_{i,1} = 0]\} - \\ \{E[Y_{i,0} \mid D_{i,1} = 1] - E[Y_{i,0} \mid D_{i,1} = 0]\} \end{aligned} \tag{5.5}$$

Given the potential drawbacks connected with of the unobservables especially as we acknowledge the transition character of all the economies in ques-

tion (see also discussion of reasons for out-of-sample analysis in Chapter 2). That is why the main weakness of the DID lies in specific country constants η_i.

Hence, if the country selection permits, we will work with two control countries rather than one. The selection of control values is undermined by foreign currency regime and relative proximity of the economies. In case of Baltic countries, Estonia will be used as control country. [1] As for the floating ER regimes, we select two countries: Czech Republic (entire period) and Slovakia (2003-2007).[2]

This will thus allow us to construct two DID estimators that can work as a benchmark values and to some extent weaken the effect of one country specific η_i.

Yet, we still recognize further potential drawbacks of the event studies. Therefore, we will not judge the measures purely subject to the DID estimators. For instance, one particular problem may be rooted in the adverse selection of the countries resorting to policy measures. Since any of the listed measures bear costs and distortion, it is quite natural to expect that only countries facing serious issues would exercise them. The selection process can be formulated:

$$D_{i,1} = \begin{cases} 1 & Y_{i,t-k} + U_{i,t} > \bar{Z} \\ 0 & \text{otherwise} \end{cases}$$

where $\bar{Z}$ stands for an excessive level of credit growth. $Y_{i,t-k}$ represent the credit growth in recent period (k is positive integer). Yet again, the estimation of excessiveness of credit growth is a demanding issue itself (see Chapter 2).

5.2 Recommendation S - case of Poland

In July 2006, Poland applied the Recommendation S to address the issue of large share of housing loans denominated in FX currency. Recommendation S combined measures targeted at FX borrowing (namely by targeting unhedged households) and non-binding guidelines for banks. The measure called banks to both assess and inform customers about FX risks. Among others, banks were to evaluate the ability of borrowers to repay FX loans in case of 20%

[1] In 2006, Estonia resorted to new procedures in reserve requirements and capital weight. Moral suasion persistently occurred over the entire period. The capital weights were adjusted so that they are in line with Basel II standards

[2] In 2008 Slovak central authorities implemented tools against the credit growth.

depreciation od the zloty and interest rate at least equal to the level of the zloty interest rate when granting the FX loans (NBP 2007).

Figure 5.1 and Table 5.1 illustrate the development of annual private credit growth before and after the application of Recommendation S. We work with the period of 13 months before and 13 months after the July 2006 (June 2005 to July 2007)[3]. The comparison is based on two possible credit growth rate: annual credit growth rate as of June 2006 as pre-treatment and as of July 2007 as post-treatment (case A). We also construct a geometric mean of specific annual credit growth rates measured over the period (case B). Geometric means may include additional information for an entire development in the pre-period or post-period. In both cases the periods are compared and differences estimated. Here DID can applied on two controls: as neither Czech Republic nor Slovakia attempted to use any measures.

Table 5.1: DID - Case of Polish Recommendation S

Case A: Annual credit growth rates as of 2006-06 and 2007-07

	Treated PL	*Controls CZ*	*Controls SK*	$PL - CZ$	$PL - SK$
t=0	0.158	0.213	0.276	-0.055	-0.118
t=1	0.305	0.244	0.198	0.060	0.107
Difference	0.147	0.031	-0.078	0.116	0.225

Case B: Geometric mean of annual credit growth rates of every month

	Treated PL	*Controls CZ*	*Controls SK*	$PL - CZ$	$PL - SK$
t=0	0.075	0.200	0.243	-0.125	-0.169
t=1	0.241	0.222	0,224	0.019	0.017
Difference	0.167	0.023	-0.019	0.144	0.186

Notes

	Start	*End*		*Start*	*End*
t=0	2005-06	2006-06	t=1	2006-07	2007-07

The figure 5.1 implies that the measures did not manage to slow down the boom but rather the other way round. However, in order to get more specific results we need to look at the target group of loans: FX-denominated housing loans. According to the figure 5.2 Recommendation S may have be efficient in slowing down the FX-denominated housing loans for the sake of increasing zloty-denominated lending.

[3]Within an event window, in April 2007, Poland adjusted the capital requirements which may be a source of further bias. However, as we discuss the overall private credit is not the best approach and when analyzing FX-denominated housing loans the capital adequacy did not have a major effect.

Figure 5.1: Effect of Recommendation S on credit dynamics - Case B

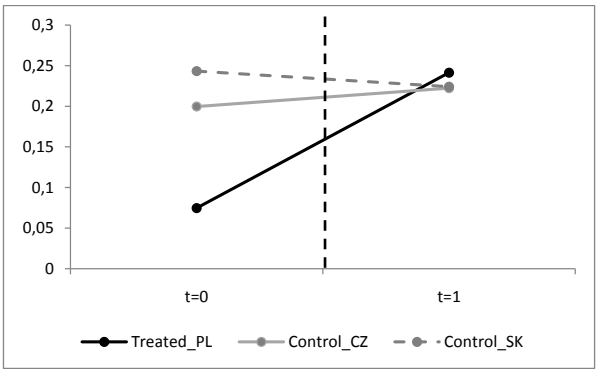
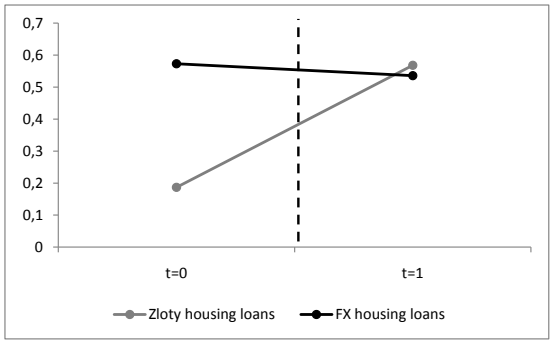


Figure 5.2: Effect of Recommendation S: Currency decomposition

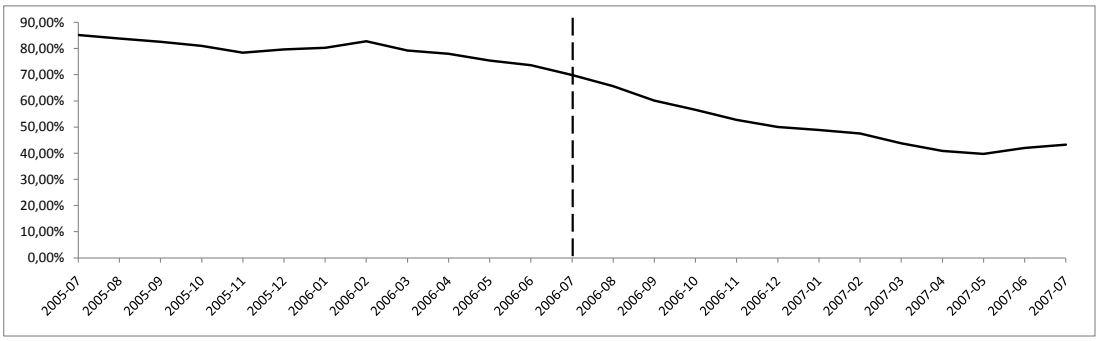


Source: National Bank of Poland (Growth rate of housing loans to households, data adjusted for exchange rates differences)

This conclusion is also in line with National Bank of Poland that also stresses the mixed effect of the tool. On plus side, it appears that the Recommendation was successful in rising the public awareness of FX risks stemmed from underlying fluctuation of the zloty exchange rate and interest rates which is why the central authority managed to cut the FX lending (Figure 5.3 illustrates the overall development of FX housing loans).

On the minus side, the credit growth continued to rise (even at faster pace). The justification is that the banks adapted to the measure by easing credit standards (e.g. easing eligibility criteria by means of LTV or LTI or extending maturities). The measure could have been even more effective since National Bank of Poland admits that such circumvention took place also for FX loans (NBP 2007). To conclude, in this case the risk arising from foreign currency exposures was transferred to some extent into credit risk.

Figure 5.3: Share of FX loans in moving averages of amounts of growth of housing loans to HH (adjusted for exchange rate differences)



Source: National Bank of Poland

5.3 Anti-inflationary plan - case of Latvia

In July 2007, Latvia introduced a new regulation to contain excessive real estate related credit boom. The measure named Anti-inflationary plan (or Economic stabilization plan) was targeted at both banks and real estate buyers. The toolkit included a set of comprehensive requirements, including limits on LTV and changes in taxes on real estate transactions. The minimum amount of initial down payment on real estate purchases was set at 10% while the limit on LTV of mortgage-backed credit at 90%. Stricter valuation criteria were also placed with respect to income situation of the borrowers - in case of loans in excess of 100 minimum monthly wages, statement of legal income was made compulsory. Furthermore, real estate stamp duty was increased and amendments to the Personal Income Law posed further requirements on speculative demand[4] (Latvijas Banka 2007).

The measures were to promote a gradual correction in real estate (mainly housing) market. The DID results of the developlments of housing loans prior and after the implementation of Anti-inflationary plan are illustrated in Table 5.2 and Figure 5.4. The event window ranges from January 2007 to January 2008, i.e. half a year before and after the event occurred. DID results report slowdown of the housing lending developments, hence success of the measure (the pace of credit housing loan growth in treated Latvia slowed down more that

[4]The revised law claimed that upon selling a real estate registered with the Land Register after 12 June 2007, the income tax must amount to 25% of the difference between the property purchase and sales prices. It is to be collected in the case of the respective property having been held by the seller for less than 60 months after its registration with the Land Register (Latvijas Banka 2007).

in case of control country Estonia). Since housing loans amount to significant percentage of the private credit, the same conclusion can be applied for overall credit developments (Figure 5.5).

Table 5.2: DID - Anti-inflationary plan in Latvia - effect on housing loans

Case A: Annual credit growth rates as of 2007-06 and 2008-01

	Treated LV	*Controls EE*	*LV - EE*
t=0	0.809	0.518	0.292
t=1	0.398	0.292	0.106
$Difference$	-0.411	-0.226	-0.185

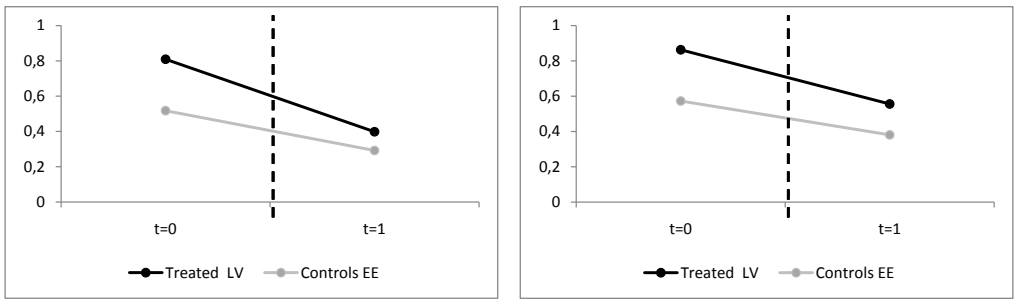
Case B: Geometric mean of annual credit growth rates of every month

	Treated LV	*Controls EE*	*LV - EE*
t=0	0.863	0.573	0.291
t=1	0.556	0.381	0.175
$Difference$	-0.307	-0.192	-0.116

Notes

	Start	End
t=0	2007-01	2007-06
t=1	2007-07	2008-01

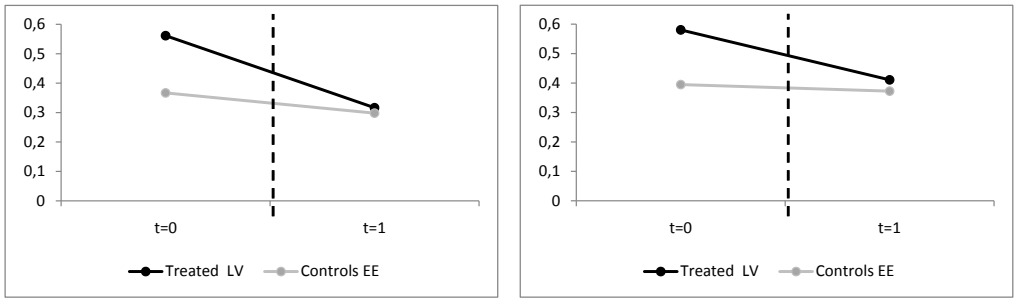
Figure 5.4: Anti-inflationary plan in Latvia - effect on housing loans



(a) Case A (b) Case B

Notwithstanding, this time period should be treated with caution: in the first part of 2007, Latvia also introduced soft measures and by tightening net open positions (See Box 5.6). Post-treatment period is not directly affected by any measures (next interventions occurred in January 2008 and raised risk weighting for mortgages in commercial property). However, the overall assessment of Anti-inflationary plan is rather difficult as the it coincides with the early stage of global financial crisis.

Figure 5.5: Anti-inflationary plan - total credit growth



(a) Case A (b) Case B

Figure 5.6: Box - Latvian new open foreign currency position calculation in 2007

Based on the survey responses, the Bank of Latvia (Latvijas Banka) reported changes in new open positions as a measure that can potentially help to control the FX lending in April 2007.
The Financial and Capital Market Commission of Latvia amended the Regulation for Calculating Capital Adequacy (effective as of May 2007). The threshold of net open position in euro was as set to 10% relative to own funds. As a result, open FX position of the banks fell from 15.5% (relative to own funds) at the beginning of the year to 3.2% at the end of the year (Latvijas Banka 2007). Analogous measure was canceled earlier in 2005. Between January 2005 and April/May 2007, euro was excluded from the calculations of open currency positions since the adoption of euro was originally scheduled for 2008.

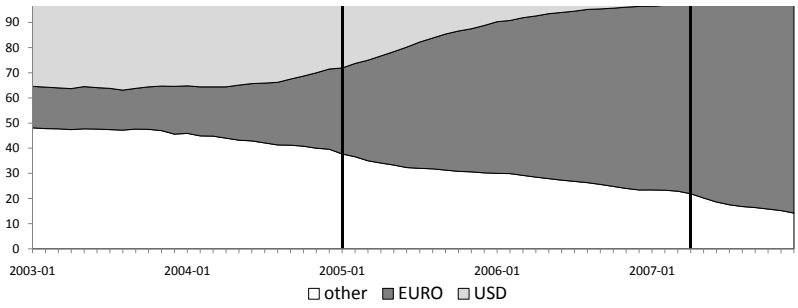


Figure represents evolution of euro-denominated borrowing in Latvia differentiated by the currency. Lines indicate changes in euro classification in/out of the calculation of open currency position.

The developments had a dampening effect of real estate credit dynamics. Martin *et al.* (2009) argue that raised funding costs, lack of confidence and limited resource availability in the global financial markets adversely affected

the Latvian banking sector, resulting in more conservative lending standards of Latvian banks. Latvijas Banka (2007) reported the drop in demand and consequent fall of real estate prices. Simultaneously, by tightened lending standards and banks also constrained financing of new projects of developers. One of the reported means of circumventions was an attempt to boost the demand via various discount offers and bonuses that however did not prove particularly successful. The corrections in the real estate market and a contraction of domestic demand materialized however the contribution of Anti-inflationary plan at the eve of financial turmoil is hard to assess separately.

5.4 Credit ceilings in SE-3

All three countries falling into the category of SE-3 sought to set administrative measures to control the credit boom. In this part we attempt to look into detail of four credit ceiling experiences: Croatia (January 2003, January 2007), Romania (September 2005) and Bulgaria (March 2005)[5].

The case of credit ceilings unfortunately cannot be evaluated via proposed DID methodology as the main assumptions are not in order. Firstly, unlike Poland or Latvia we cannot select a control country that would have correspondent path of credit developments. Secondly, all three countries were very active by means of policy measures and hence the event window cannot be selected properly.

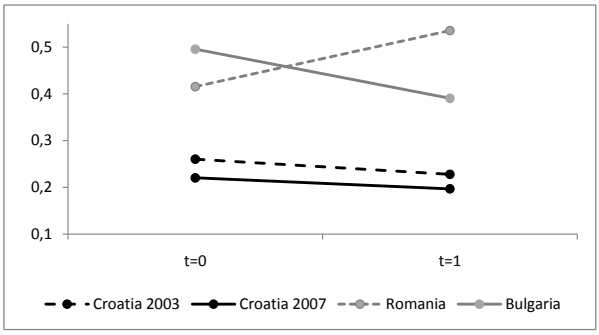
Nonetheless, there are other points to consider: credit ceilings are the strongest, most directed and quantitatively most restrictive approach to control the credit growth. The countries implemented four variously defined credit controls over a long period of time (first ceiling being implemented in 2003 and last being removed in 2009).

As a result we attempt to look at the credit ceilings from different perspective. First, we let us denote time $t = 0$ as a time of implementation of the restriction for each country. Then we denote $t = -n$ as a time n months prior to the credit growth and $t = +n$ analogously. For the sake of simplicity we will start looking at the credit changes before and after event date (we assume all measures started at $t = 0$ irrespective of actual time). Due to the hight intensity of measures we will work with two different event windows: 12 months

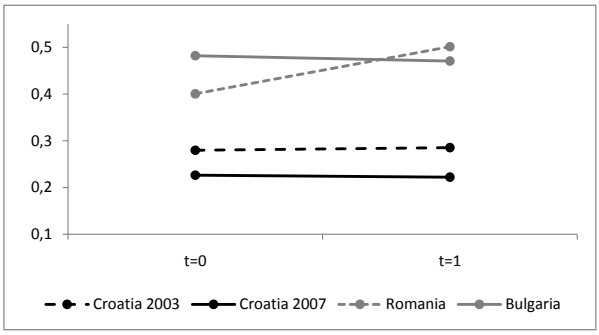
[5]The date in parenthesis indicate the year of implementation.

and 6 months. We derive the differences in pre-treatment and post-treatment period for every country (see table B.2) and plot the basic figures (figure 5.7).

Figure 5.7: Credit developments prior and after the credit ceilings



(a) One year window

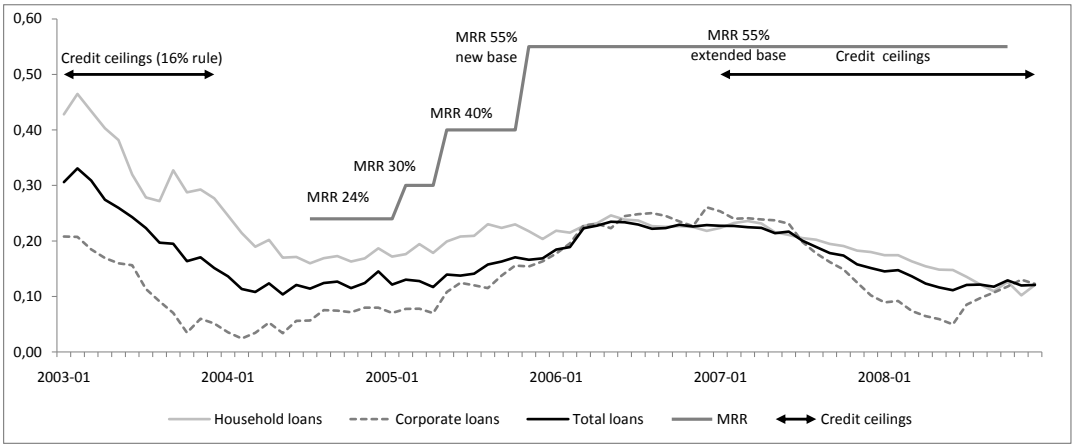


(b) Half a year window

Results of both event windows are consistent, albeit we can observe higher the dynamics over longer period. Extending windows to even larger time span would not make much sense since the first credit ceiling of 2003 in Croatia was removed after one year and the last Croatian credit ceiling coincides with the financial crisis.

What can be inferred from the results? The country with the highest credit dynamics prior to credit ceilings (Bulgaria) was the most successful in curbing the growth at least in the short-term period. Shortly after March 2005 implementation of credit ceilings, quarterly limits on the penalty-free growth of credit were extended beyond the originally one-year planned period until the end of 2006. Consequently, the MRR (penalty rates) were temporarily risen subject to the size of "crossing the speed limit". When banks exceeded the ceiling by 1-2%, MRR were increased from 200% to 300%. When breaking the limit by more than 2% MRR were set to 400% . This amendment was however only of temporary character (May 2006 - August 2006).

Figure 5.8: Credit ceilings and MRR in Croatia



Results may suggest that two Croatian credit experiences were fairly alike. Yet, the design of 2007 was performed more carefully than the early credit controls and is along with other prudential tools considered to achieve more success (IMF 2010). The first era of credit ceilings in Croatia is often referred as "the 16% rule" as the tool urged bank lending to grow be less that 4% per quarter (16% per annum). Otherwise banks were obliged to by low-interest HNB bills at penalty rates twice as high as the excess credit.

Such a speed limit did contribute to some deceleration namely in case of household lending (see Figure 5.8 that did not have at the time a good access to direct FX borrowing alternative. The Figure also suggests a fall in corporate loans, these were however substituted by direct FX borrowing from parent banks, a very popular channel of circumvention. In conclusion, local banks adjusted to the new limits by shifting the activities to either mother banks or less-supervised affiliated leasing companies. Since 2004 this measure was hence discontinued and replace by series of marginal reserve requirements.

The second era of credit ceilings was built upon the lessons learned from "the 16% rule" of 2003. In particular, it covered selling of credit portfolio and credit risk. Loans of affiliates were also covered in the allowed speed limit which was set at 12% annual credit growth. In other words, if banks exceed 12% annual credit growth, they were to purchase HNB bills. The results are quite favorable but corresponding to the "the 16% rule": housing loans were managed to put under control and corporate credit remained high thanks to direct borrowing.

Romanian controls were aimed at limiting FX credit exposure of unhedged borrowers: total loans were not allowed to exceed 300% limit of own funds (in other words a limit on DTI). Based on our the results the experience of Romania was not successful (the credit growth continued to rise even at higher pace).

This conclusion is also in line with overall evaluation of Romanian measures by Popa (2007) and National Bank of Romania (survey response). They both acknowledge that quantitative constraints despite producing short term effects were not able to slow down the lending at its full. Popa (2007) also emphasizes that the measure was aimed to constrained the activities of more risk preferring credit institutions (wider range than banking system exposure). That is also why he admits that most of these institutions preferred to raise their capital endowment rather than restructure and lower the credit portfolios.

Figure 5.9: Credit ceilings and and currency differentiation in Romania

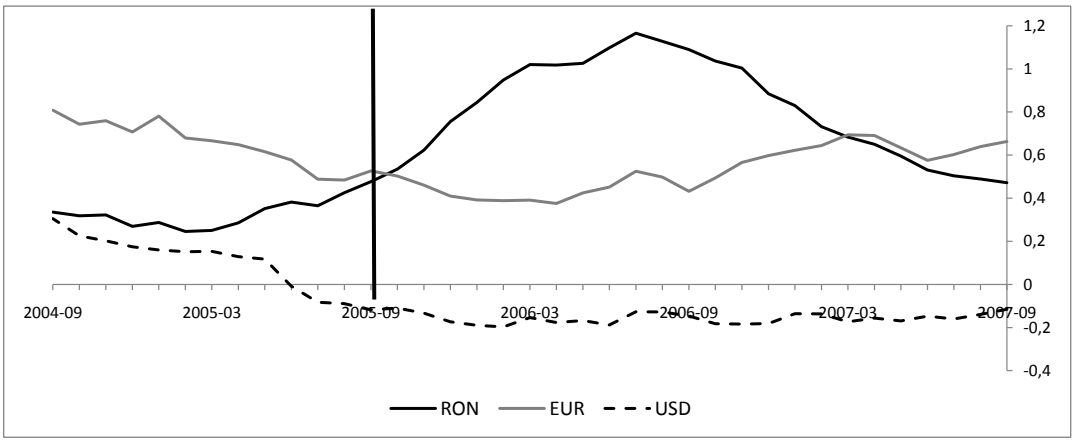


Figure 5.9 provides more concise effect of credit ceilings in September 2009. The result resembles the case of Poland: FX-denominated lending was lowered for the sake shift hike of domestic loans. Based on the data, even though the credit growth was not curbed, the FX restrictions were effective as they channeled credit to domestic loans that are easier to manage by means of conventional policy tools. Nonetheless, the circumvention via direct FX borrowing from foreign mother banks still remains an issue.

Chapter 6

Conclusion

Within eleven CEE countries we are able to identify various paths of credit development and degrees of interventions to the dampen its dynamics.

Based on the panel data FE OLS model we compared the actual private credit development with the derived long-run equilibrium level. The findings suggest that all countries witnessed uprising trend of private credit in the period of 2003-08. Moreover, all the economies already reached the long-term equilibrium at least by the upper estimate of derived oscillation range. Our calculations further predict that five out of eleven economies fully crossed the long-run equilibrium, implying that their private credit can be considered as excessive.

Rapid credit growth poses many risks to the financial stability. Hence, we performed a survey across the central banks in the region aimed at identification of the behavior of policymakers to the credit boom. The survey consisted of three main issues: *a*) monetary policy measures, *b*) prudential and supervisory measures, and *c*) administrative and other administrative measures.

The main conclusions are as follows. First, exchange rate framework played a crucial role both in scale and scope of the responses. The fears about the excessiveness of the credit growth originated mainly in fixed exchange regimes. Having their hand tied in case of interest rate or exchange rate tools, countries introduced a wide scale of prudential, supervisory and administrative measures. Yet the effectiveness of the measures with respect to the credit slowdown was often fairly limited and short-lived as banks and local agents quickly found a new way of circumvention. Nevertheless, we acknowledge that specific prudential tools may have contributed to fostering the resiliency of the financial sector per se. On the other hand, flexible exchange rate regimes did not face

as dramatic a credit evolution. However, countries still attempted to correct for maturity or currency mismatches.

Second, excessive FX borrowing was very often the main target of the policy measures. Unfortunately, the success was rare due to a number of circumvention practices. Among others, the most common circumvention was to switch to direct cross-border borrowing from the foreign parent banks or to shift to less supervised channels such as leasing companies. The cross-border borrowing did not only substantially limit the effectiveness of the measures but it also introduces more distortions as the system did not respond appropriately to the conventional measures such as interest rates or reserve requirements. As a result we strongly argue that design of the policy tool must reflect domestic environment and position of the foreign banks to help alleviate the risks entailed in the credit growth.

Third, last chapter of the thesis was dedicated to the difference-in-differences (DID) estimations to study the impact of policy measures. Based on the survey results we were able to find matching control and treated countries to observe the effect of a policy intervention. The DID illustrate results of mixed successes due to the wide-spread circumvention practices.

In total we obtained 82 specific policy measures implemented separately or as a policy mix. This is an extremely rich record given the amount of economies and the time span. Unfortunately, since majority of the measures were implemented in the late phase, they coincide with the financial crisis and hence their contribution to the slowdown is very hard to assess.

In this thesis we discussed the policy responses via survey results and concise event studies for particular cases. Our planned future research should look into policy measures in greater dept. Furthermore, it would be also interesting to extent the period of the research behind the eve of the financial crisis and evaluate its effect of the policy toolkits. In addition, CEE lessons have a lot to offer not only to the region but also as a contribution to the ongoing macroprudential debate.

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Appendix A

Credit growth dynamics

Having panel macro data for last 25 years, the potential non-stationarity may a concern. Therefore, set of unit root tests was applied: Levin *et al.* (2002), Im *et al.* (2003) and Breitung (2000). The first and the latter tests assume all panels to contain unit roots while Im *et al.* (2003) allows for heterogenity among panels. Table A.1 provides test results on levels and table A.2 reports test results on the first differences. The results imply the most series to be I(1) processes, but in some cases there are conflicting results among tests on level data. Nonetheless, there is no conflict in test results on the first difference and we can conclude the data to be I(1) processes. This result is also in accordance with original model Égert *et al.* (2006).

Table A.1: Unit root tests for panel data - levels

	Levin-Lin-Chu		Im-Pesaran-Shin		Breitung	
Variable	**t-statistics**	**p-value**	**t-statistics**	**p-value**	**lambda**	**p-value**
cp	5.3344	1.0000	7.0470	1.0000	5.5576	1.0000
capita	14.7536	1.0000	-28.0145	0.0000	3.6313	0.9999
cg	2.5503	0.9946	1.8193	0.9656	1.0452	0.8520
i_lending	0.8838	0.8116	7.0061	1.0000	2.9216	0.9983
p_ppi	-6.4290	0.0000	-4.9299	0.0000	-1.0312	0.1512
spread	0.9293	0.8236	2.7683	0.9972	2.7262	0.9968

Levin-Lin-Chu: and Breitung:
Ho: Panels contain unit roots
Ha: Panels are stationary

Im-Pesaran-Shin:
Ho: All panels contain unit roots
Ha: Some panels are stationary

Next the cointegration was tested. As we use the model to derive long-term relationship between private credit-to-GDP and all the listed explanatory variables, we need the data to be cointegrated. For this very purpose we first

Table A.2: Unit root tests for panel data - first differences

	Levin-Lin-Chu		Im-Pesaran-Shin		Breitung	
Variable	**t-statistics**	**p-value**	**t-statistics**	**p-value**	**lambda**	**p-value**
d_cp	-11.2685	0.0000	-22.9737	0.0000	-17.2293	0.0000
d_capita	-12.6788	0.0000	-33.6960	0.0000	1.7430	0.9593
d_cg	-17.1150	0.0000	-25.5869	0.0000	-15.5816	0.0000
d_i_lending	-12.4102	0.0000	-17.9390	0.0000	-10.4592	0.0000
d_p_ppi	-12.1525	0.0000	-17.7035	0.0000	-11.5653	0.0000
d_spread	-12.6140	0.0000	-20.8484	0.0000	-12.2918	0.0000

Levin-Lin-Chu: and Breitung: Im-Pesaran-Shin:
Ho: Panels contain unit roots Ho: All panels contain unit roots
Ha: Panels are stationary Ha: Some panels are stationary

tried to apply the Westerlund & Persyn (2008) error-correction/cointegration test that implements the four panel cointegration tests. However, it requires that the country series do not have any gaps which is not valid for two countries in our dataset.

As a result, we followed the cointegration tests described by Égert *et al.* (2006): applying the pooled mean group estimator (PMGE) suggested by and using the error correction term ρ as test for cointegration. A negative and statistically significant error correction term is takes as evidence for the presence of cointegration (Égert *et al.* 2006). According to the results illustrated in table A.3 the error correction term is estimated as fulfills the double criteria.

Table A.3: Estimation results : PMGE
C^{P}=f(CAPITA,C^{G},$i^{lending}$,p^{PPI},spread)

Variable	**Coefficient**	**(Std. Err.)**	
ρ	-0.056	(0.012)	***
cg	-0.197	(0.041)	***
capita	1.055	(0.187)	***
i_lending	0.132	(0.059)	***
p_ppi	1.182	(0.535)	***
spread	-0.115	(0.060)	**

Appendix B

DID results

Table B.1: DID - Anti-inflationary plan

Case A: Annual credit growth rates as of 2007-06 and 2008-01

	Treated LV	*Controls EE*	*LV - EE*
t=0	0.561	0.367	0.194
t=1	0.316	0.298	0.018
$Difference$	-0.245	-0.069	-0.176

Case B: Geometric mean of annual credit growth rates of every month

	Treated LV	*Controls EE*	*LV - EE*
t=0	0.581	0.395	0.186
t=1	0.411	0.373	0.038
$Differences$	-0.170	-0.022	-0.147

Notes

	Start	End
t=0	2007-01	2007-06
t=1	2007-07	2008-01

Table B.2: Capital ceilings in SE-3

One Year window

Case A: Geom. mean of annual credit growth rates observed monthly

	Start	*End*	*Croatia 2003*	*Croatia 2007*	*Romania*	*Bulgaria*
t=0	t-12	t-1	0.260	0.220	0.415	0.496
t=1	t	t+11	0.228	0.197	0.535	0.390
Difference			-0.033	-0.024	0.120	-0.105

Case: B Annual credit growth rates as of t-1 and t+11

	Start	*End*	*Croatia 2003*	*Croatia 2007*	*Romania*	*Bulgaria*
t=0	t-12	t-1	0.305	0.229	0.416	0.474
t=1	t	t+11	0.151	0.151	0.587	0.289
Difference			-0.154	-0.078	0.171	-0.185

Half a year window

Geometric mean of annual credit growth rates observed in every month

	Start	*End*	*Croatia 2003*	*Croatia 2007*	*Romania*	*Bulgaria*
t=0	t-12	t-1	0.280	0.226	0.401	0.482
t=1	t	t+11	0.285	0.222	0.502	0.471
Difference			0.006	-0.004	0.101	-0.012